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METABOLISMO DE LIPÍDEOS EM GATOS:

Estudo da aceitação de ácidos graxos de cadeia média e dos efeitos da inclusão de ácido γ-linolênico na formação de ácido araquidônico

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Metabolismo de lipídeos em gatos: estudo da aceitação de ácidos graxos de cadeia média e dos efeitos da inclusão de ácido γ-linolênico na formação de ácido araquidônico[1]

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RESUMO

Os lipídeos representam uma porção importante da dieta dos carnívoros. São responsáveis pelo fornecimento de energia e ácidos graxos essenciais. Ácidos graxos de cadeia média são conhecidos por causar recusa alimentar em gatos. Gatos são incapazes de dessaturar ácido linoléico (AL) para formar ácido araquidônico (AA) devido à baixa atividade enzima Δ6 desaturase. O objetivo deste trabalho foi determinar se haveria aversão à dieta, alterações nos lipídios e lipoproteínas plasmáticas em gatos alimentados com dietas contendo triglicerídeos de cadeia média (TCM). O segundo trabalho teve como objetivo determinar se aumentando a concentração de AL seria possível induzir Δ6 desaturase a produzir ácido γ-linolênico (GLA) e, em seguida, a síntese de AA, ou se outra via alternativa existiria para produzir AA independentemente da enzima Δ6 desaturase. Vinte e nove gatos adultos, fêmeas, clinicamente normais foram divididos aleatoriamente em três grupos alimentados por 8 semanas com dietas diferindo apenas no perfil lipídico (baixo AL com alto TCM (LL ou HMCT) n = 10; alto AL (HL ou LMCT) n = 9; e outros com dieta GLA (GLA) n = 10. Os gatos foram alimentados de acordo com o seu peso metabólico (100 kcalEM*$kg^{0.67}$$dia^{-1}$). O consumo diário, peso corporal semanal (PC) e escore de condição corporal (ECC, 1-9, ideal=5) foram utilizados para ajustar o consumo diário e calcular a energia de mantença para cada gato, visando ECC ideal. Amostras de sangue foram obtidas após jejum noturno no dia 0, 14, 28 e 56, sendo avaliados triglicerídeos plasmáticos (TG), colesterol total (CT) e suas frações (LP-C). No segundo experimento, estudou-se o perfil dos ácidos graxos dos fosfolipídeos plasmáticos e das membranas plasmáticas das hemácias. No primeiro e segundo estudo medidas repetidas no tempo - ANOVA e teste de Tukey (α=0,05) para comparação múltipla não revelaram diferenças entre as dietas com relação ao consumo alimentar, PC, ECC e exigência basal de energia quando a primeira semana deixou de ser considerada. No primeiro estudo a dieta HMCT aumentou significativamente TG, porém os valores ficaram dentro da normalidade para a espécie. Não foram observados efeitos sobre CT ou LP-C entre dietas, somente efeito de tempo. O segundo estudo não demonstrou uma via alternativa para formar AA. A enzima Δ6 dessaturase mostrou-se inativa, mesmo na dieta com alta concentração de substrato (AL). Porém, quando GLA foi adicionado a concentração de AA nos tecidos foi mantida. Os resultados destes estudos demonstram que gatos consomem TCM sem recusa alimentar e que não existe uma via alternativa funcional para a formação de AA, mas gatos são capazes de produzi-lo quando GLA é incluído na dieta.

[1] Tese de Doutorado em Zootecnia – Produção Animal, Faculdade de Agronomia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS. (159p.) Fevereiro de 2009.

Lipids metabolism in cats: study of the acceptance of medium-chain fatty acids and effects of the inclusion of γ-linolenic acid in the formation of arachidonic acid[2]

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ABSTRACT

Lipids represent an important portion in carnivorous diets. It can provide energy and essencial fatty acids. Medium-chain fatty acids are known to cause aversion in cats when it is including in the diet. Cats are incompetent to desaturate linoleic acid (LA) to form arachidonic acid (AA) because of Δ6 desaturase seem like to be very low activity. The first objective was to determine possible diet aversion, lipid and lipoprotein alterations in cats fed diets containing medium chain triglycerides (MCT). In the second work the objective was to determine if including high amount of LA acid could induce Δ6 desaturase to produce γ-linolenic acid (GLA) and then AA, or if other pathway could be possible to produce AA without Δ6 desaturase. Both trials were conducted together. Twenty nine clinically normal, adult female cats were randomly assigned into three groups fed diets differing only in the lipids profile (Low LA with high MCT (HMCT or LL diet) n=10; high LA (LMCT or HL diet) n=9; GLA (GLA diet) n=10) fed for 9 weeks. Cats were fed according to their metabolic body weights (100 kcalME*Wkg$^{0.67}$day^{-1}). Daily consumption records, weekly body weights (BW), and body condition scores (BCS, 1 to 9 scale where 5 is ideal) were used to adjust amounts fed and to calculate daily metabolic energy factors for each cat to maintain an ideal BCS. Blood samples were obtained after overnight fasting at day 0, 14, 28 and 56 for plasma triglyceride (TG), total cholesterol (TC), and lipoprotein cholesterol distribution (LP-C). In the second study red blood cells and plasma phospholipids fatty acids profile were performed. In the first and second study repeated measures ANOVA and Tukey (α=0.05) multiple comparison tests revealed no differences between diets with respect to food consumption, BW, BCS, and maintenance energy requirement (MER) if first week could be removed from de analyses. In the first study a statistically significant diet effect on plasma TG was seen with the HMCT diet; however values were within the normal feline range. No diet effects were seen on TC or LP-C. The second study showed no alternative pathway from LA to form AA. The Δ6 desaturase was inactive even though when high amount of LA was provided. When Δ6 desaturase step was bypassed the concentration of AA acid in the tissues was maintained, showing the possible way to provide efficient precursor for AA synthesis. Cats consumed the diet normally and no alterations in plasma parameters were observed between groups. Time effect was observed increasing all parameters until week 4 and decreasing to the same levels week 2 at week 8. Results of these studies demonstrate that it is feasible to include MCT in normal feline diets without refusal and with minimal effect on lipid metabolism and that there is no functional alternative pathway to AA, but cats are able to produce it when GLA is included in the diet.

[2] Doctoral thesis in Animal Science, Faculdade de Agronomia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil (159p.) February, 2009.

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RELAÇÃO DE ABREVIATURAS E DE SÍMBOLOS

AA	Ácido araquidônico / Arachidonic acid
AGCL	Ácido graxo de cadeia longa
AGCM	Ácidos graxos de cadeia média
AGE / EFA	Ácidos graxos essenciais / Essential fatty acid
AL / LA	Ácido linoleico / Linoleic acid
ALA	Ácido α-linolênico / α-linolenic acid
BCS	Body condition score
BW	Body weight
DE	Digestible energy
DGLA	Ácido dihomo-γ- linolênico
DHA	Ácido decosaexaenóico
DM	Dry matter
EPA	Ácido eicosapentaenóico
FA	Fatty acids
GLA	Ácido γ-linolênico / γ-linolenic acid
HL	High linoleic
HMCT	High medium-chain triglycerides
LL	Low linoleic
LMCT	Low medium-chain triglycerides
LP-C	Lipoprotein cholesterol

LTB4	Leukotrienes serie 4
MCFA	Medium-chain fatty acids
ME	Metabolic energy
MER	Maintenance energy requirement
PED	Pre-experimental diet
PG	Prostaglandines
PL	Phospholipids
PLFA	Plasma phospholipids fatty acids profile
Pre-β-LP-C / VLDL	Pre-beta lipoprotein fraction / Very low density lipoprotein
RBC	Red blood cells
RBCPL	Red blood cell membranes phospholipids
TC	Total cholesterol
TCL / LCT	Triglicerídeos de cadeia longa / Long-chain triglycerides
TCM / MCT	Triglicerídeos de cadeia média / Medium-chain triglycerides
TG	Triglicerídeos plasmáticos / Triglycerides
α-LP-C / HDL	Alpha lipoprotein fraction / High density lipoprotein
β-LP-C / LDL	Beta lipoporotein fraction / Low density lipoprotein
Δ6 Dessaturase	Delta 6 dessaturase

CAPÍTULO I

1.1 Introdução

Cães e gatos representam a maior população de animais de companhia do mundo. O número de animais agregados às famílias é uma tendência em evolução. Gatos, por seu comportamento peculiar, têm se mostrado uma espécie bastante interessante para o sistema de vida atual, no qual há uma limitação no tempo de convívio entre homem e animal. No Brasil, seguindo a tendência Norte Americana, o número de animais de estimação tem crescido. O Brasil possui o segundo maior número de animais de companhia do mundo (31 milhões de cães, 14 milhões de gatos) (ANFAL PET, 2009) ficando somente atrás dos Estados Unidos (EUA - 74,8 milhões de cães, 88,3 milhões de gatos) (McLeod, 2009). Como nos EUA a população de gatos ultrapassa a de cães pressupõe-se que esta será a realidade brasileira a médio prazo.

A evolução zoológica dos felídeos como carnívoros estritos gerou espécies bastante exigentes quanto à alimentação e à nutrição. As diversas particularidades metabólicas dos felídeos tem sido um desafio para nutricionistas e pesquisadores, exigindo atenção no processo de escolha de ingredientes e nutrientes para a confecção de dietas secas que atendam todas as suas exigências nutricionais. Além das elevadas necessidades protéicas exigidas pelos felídeos, devido a sua incapacidade de reduzir a atividade de suas aminotransferases (Schimke, 1962), como fazem outras espécies, gatos exigem outros nutrientes como a arginina, vitamina D e A, niacina e ácido araquidônico (AA) pré-formados (Rogers & Morris, 2007).

Junto às necessidades nutricionais e suas particularidades, gatos são sensíveis ao paladar, textura e cheiro dos alimentos, devendo-se ter atenção na produção de dietas específicas para gatos, do contrário os gatos apresentam um alto grau de rejeição ao alimento (Kvamme, 2003).

O atual conhecimento a respeito da nutrição de gatos foi gerado a partir de pesquisas iniciadas na década de 70. Na época, a grande dificuldade estava em fazer com que os gatos ingerissem as dietas purificadas, pouco palatáveis a estes animais, fato que foi contornado com a descoberta de substâncias palatabilizantes. Vencida esta barreira, a manutenção das colônias e as doenças infecto-contagiosas tornaram os biotérios de felinos difíceis de serem mantidos. Mas o metabolismo intrigante deste carnívoro e a afeição do homem para com o animal foram fundamentais para a intensificação nas pesquisas e o desenvolvimento de dietas cada vez mais balanceadas (Rogers & Morris, 2007).

No entanto, certas rotas metabólicas continuam sendo investigadas. O metabolismo de lipídeos em felinos permanece em discussão. Pesquisas em outras espécies revelaram uma série de ingredientes lipídicos com propriedades interessantes para a utilização em dietas convencionais e terapêuticas para gatos. Neste contexto, os ácidos graxos de cadeia média (AGCM) apresentam uma série de propriedades funcionais devido à forma como são absorvidos e metabolizados, podendo ter potencial na nutrição de felídeos. Entretanto, muitos estudos revelaram à baixa palatabilidade destes

ácidos graxos quando compondo dietas para diferentes espécies, inclusive um relato em gatos (Wanten & Naber, 2004).

Outro aspecto do metabolismo de lipídeos de grande importância em gatos são as rotas de síntese do AA. O AA e seus precursores são usualmente encontrados em baixas concentrações nos alimentos industrializados para gatos. A engenharia genética, associada a novas espécies vegetais desenvolvidas e cultivadas (Huang et al., 2001; Liu et al., 2001), assim como os métodos de extração e separação de lipídeos a partir dos compostos vegetais e fermentados fúngicos tem ajudado na produção e concentração de alguns ácidos graxos que antes não eram encontrados facilmente nos alimentos (Carvalho et al., 2003; Sagilata et al., 2008). Este é o caso do óleo de borragem, que pode ser concentrado e originar um óleo com 70% de ácido graxo γ-linolênico (GLA, 18:3 n6) (Sanmark). Este ácido graxo em particular, pode ter função importante na nutrição de felinos. Para a maior parte das espécies a síntese orgânica deste composto ocorre pela ação de uma enzima Δ6-desaturase sobre o ácido linoléico (AL, 18:2 n6). No entanto, felinos demonstram nenhuma ou muito baixa eficiência nesta enzima, de forma que a síntese de AA (20:4 n6) fica comprometida. Além disso, a inclusão deste ácido graxo na dieta pode ser ferramenta para o melhor entendimento das vias de produção de AA, bem como atividade da cascata enzimática pertinente à síntese do AA.

1.2 Revisão Bibliográfica

1.2.1 Gorduras

Mediante a classificação generalista, todos os compostos que se mostram solúveis em solventes orgânicos e insolúveis em água são classificados como lipídeos. No entanto, resultante do processo de extração pelos solventes orgânicos nem todas as substâncias apresentam a mesma proximidade molecular. Exemplo clássico são os pigmentos vegetais e as vitaminas A, D, E e K, que são extraídos juntamente com os lipídeos (Gurr et al., 2002). Os lipídeos de interesse podem ser classificados como: lipídeos simples, que compreendem os triglicerídeos (ácidos graxos unidos a uma molécula de glicerol) e as ceras (contém um número maior de ácidos graxos unidos a uma molécula de álcool de cadeia longa); lipídeos compostos, que constam de um ácido graxo, unido a uma molécula não lipídica, que pode ser uma proteína, um carboidrato ou outros compostos como fósforo e nitrogênio (exemplo: lipoproteínas, glicoproteínas e fosfolipídeos). Ainda existem lipídeos derivados de compostos de esterol, como o colesterol (Case et al., 2000).

O triglicerídeo é o tipo de gordura mais importante na dieta e pode ser diferenciado nos alimentos, dependendo do tipo de cada ácido graxo contido em cada triglicerídeo e da posição que este ácido graxo ocupa no glicerol (Gurr et al., 2002). A maioria dos triglicerídeos contidos nos alimentos contém ácidos graxos de cadeia longa (AGCL - variando entre 14 e 24 átomos

de carbono). No entanto, dois alimentos fogem à regra, os derivados lácteos e o óleo de coco, ambos contendo apreciável quantidade de AGCM (NRC, 2006).

1.2.1.1 Função

De acordo com Bauer (2006) os lipídeos dietéticos podem ser divididos em dois grupos por suas funções: os lipídeos que atuam como fonte de energia, melhorando a textura do alimento e aumentando a palatabilidade, e os lipídeos funcionais, do qual fariam parte os lipídeos ditos essenciais, como o AL e o ácido α linolênico (ALA) e alguns de seus derivados, dependendo da espécie e da faixa etária que se deseja atender (NRC, 2006).

As gorduras possuem numerosas funções no organismo. Os triglicerídeos constituem a maior forma de armazenamento de energia. Enquanto as reservas de carboidratos são extremamente limitadas nos animais, os triglicerídeos podem ser depositados de forma quase ilimitada. A maior parte dos depósitos de gordura localizam-se sob a pele, na forma de gordura subcutânea, ao redor dos órgãos vitais e nas membranas que rodeiam os intestinos. Alguns destes depósitos podem ser observados com facilidade em animais obesos. Este tecido possui mobilidade estática, a síntese e a degradação ocorrem para armazenamento e produção de energia, respectivamente. Ainda assim, possui a propriedade de isolante térmico e confere proteção física a regiões vitais do organismo (Case et al., 2000).

Além da propriedade energética as gorduras têm funções metabólicas e estruturais. Uma camada isolante de gordura rodeia as fibras nervosas e contribui para a transmissão de impulsos nervosos. Os fosfolipídeos

e os glicolipídeos são compostos esterificados de ácidos graxos que atuam como componentes estruturais das membranas celulares e participam no transporte de nutrientes e metabólitos através da membrana, conferem fluidez, compressibilidade, permeabilidade e capacidade de fusão (Bauer, 2006). As lipoproteínas permitem o transporte de gorduras via corrente sanguínea. O colesterol é precursor de hormônios esteróides e está envolvido na formação dos sais biliares, necessário para correta absorção e digestão dos lipídeos. Juntamente com outros lipídeos, o colesterol forma uma camada protetora na pele que evita a dessecação excessiva e a invasão de substâncias estranhas (Case et al., 2000).

Na dieta a gordura é a forma mais concentrada de energia, mais concentrada do que qualquer outro nutriente. Ainda que a energia fornecida pelos carboidratos e pelas proteínas estejam ao redor de 4 kcal/g a energia da gordura fornece mais que o dobro disto, cerca de 9 kcal/g (NRC, 2006). Quando são fornecidas misturas de gordura animal e vegetal aos cães o coeficiente de digestibilidade da gordura fica em torno de 90%, podendo chegar a 95%, de forma que sua digestibilidade supera a da proteína e dos carboidratos. Assim, o aumento de gordura na dieta, além de aumentar a densidade energética, promove maior digestibilidade, importante para dietas de animais de companhia. Além disso, a inclusão de gordura na dieta de cães e gatos torna o alimento mais palatável, pois interfere com aroma, sabor e textura no produto acabado (Kendall, 1984). De fato, concentrações mais elevadas de gordura (25 a 40%) são preferidas por cães e gatos. Ao mesmo tempo, este conteúdo elevado em gordura pode ser um problema para animais que não

fazem bem o controle da ingestão pelo valor calórico do alimento, podendo ocorrer casos de excesso de peso e obesidade em cães e gatos (Case et al., 2000).

1.2.2 Ácidos graxos

Estruturalmente são ácidos carboxílicos com cadeia variando entre 2 e 26 carbonos, conectados uns aos outros por ligação simples ou dupla. Apresentam um grupamento carboxílico (COOH) em uma extremidade e um grupo metil (CH3) na outra (Gurr et al., 2002).

1.2.2.1 Denominação

A posição em relação ao grupo metil indica o carbono ômega (n) e a posição em relação ao grupamento carboxila indica a posição Delta (Δ), dessa forma pode-se reconhecer estruturas que são isômeras (Reinhart, 1996a). Por exemplo, quando se trabalha com o ácido dihomo-γ-linolênico (DGLA - 20:3 n6), este possui um isômero de posição, ambos n6. A posição Δ é o diferencial entre os dois ácidos graxos: 20:3 n6 Δ5,11,14 e o outro 20:3 n6 Δ8,11,14, (Gurr et al., 2002). De forma geral, a ligação Δ está ligada ao nome da enzima que aplica a insaturação (NRC, 2006).

Uma das mais clássicas classificações é a dos ácidos graxos essênciais, são divididos fisicamente ou quimicamente em dois grupos de acordo com a ligação com o grupo metil, mais próximo ou mais final. Na nutrição de mamíferos em geral destacam-se os grupamentos Ômega 3 e Ômega 6. Felídeos possuem particularidades na metabolização destes compostos devido a alterações específicas nas vias enzimáticas (Bauer, 1997)

1.2.2.2 Síntese e degradação

Felinos, assim como todos os mamíferos podem sintetizar ácidos graxos saturados e com uma insaturação, (independentemente do tamanho da cadeia carbônica, a partir de Acetil-CoA (Salati & Goodridge, 1996). As dietas ricas em gordura, com grande concentração de ácidos graxos monoinsaturados (16:1 n7 e 18:1 n9), são inibidoras das enzimas que fazem a insaturação de ácidos graxos saturados (NRC, 2006). Dessa forma, quando dietas com altas concentrações de carboidratos e proteínas são fornecidas aos animais as atividades destas desaturases se elevam. No entanto, insaturações duplas a partir de compostos de 18 carbonos na posição n3 e n6 são impossíveis em felídeos e estes ácidos graxos se tornam essenciais, devendo, portanto ser fornecidos via dieta. Plantas possuem as enzimas necessárias para a síntese destes compostos, sendo o AL e o ALA abundantes em ingredientes de origem vegetal. Esta capacidade de síntese está ligada à expressão de duas enzimas indispensáveis no processo, a Δ12 e a Δ15 desaturases (Cook, 1996). Curiosamente, após a síntese de AL e ALA a maior parte das plantas não adicionam demais insaturações nestes compostos, não sendo encontrados outros ácidos graxos importantes como o AA, ácido decosaexaenóico (DHA) e ácido eicosapentaenóico (EPA) em óleos vegetais (Gurr et al., 2002).

Plantas marinhas, zooplânctrons e fitoplâctons são capazes de adicionar insaturações especialmente na série n3, podendo elongá-los até a produção de EPA e DHA (Cook, 1996). Mamíferos herbívoros também o fazem, mas especialmente os carnívoros apresentam certa debilidade neste processo.

O processo evolutivo e o consumo concomitante de ingredientes de origem animal provavelmente tenham contribuído para a redução da expressão das enzimas responsáveis pela iniciação das desaturações nos ácidos graxos de cadeia longa (Rogers & Morris, 2007). Felídeos, como carnívoros estritos, talvez sejam uma das espécies mais afetadas. É sabido que gatos são incapazes de insaturar o AL para formar o GLA, devido a ausência completa ou parcial da enzima Δ6 desaturase. Consequentemente, não são capazes de produzir AA, um componente lipídico essencial para felinos. Dessa forma, a dieta deve fornecer AA para estes animais (Rivers et al., 1975; Pawlosky et al., 1994).

Sabe-se que ambas as séries, n3 e n6, não são interconversíveis e dependem das mesmas enzimas para dessaturar e elongar ácidos graxos. Assim, felídeos privados de dietas animais poderiam sofrer deficiência em ambas as séries. Embora sejam reconhecidos os sinais da deficiência de AL em gatos, com sinais como pele seca, descamativa, pelo sem brilho, infertilidade e lipidose hepática (Hassan et al., 1977; Rivers, 1976 ab; Frankel & Rivers, 1978; Rivers, 1982), nenhum sinal de deficiência específica foi provada para o ALA, muito embora a indicação de uma concentração mínima já estar descrita para gatos em crescimento (NRC, 2006).

1.3 Caracterização de ácidos graxos pelo comprimento das cadeias carbônicas

1.3.1 Ácidos graxos de cadeia curta

Os ácidos graxos de cadeia curta são compostos por cadeias de 2, 3 e 4 carbonos sem insaturações: ácido acético, ácido propiônico e ácido butírico, respectivamente. Não são encontrados normalmente compondo triglicerídeos e de forma geral são produto do metabolismo microbiano, cuja importância é significativa para animais que fazem fermentação. Nos monogástricos estes ácidos graxos têm função importante no metabolismo absortivo intestinal, já que são as principais fontes de energia dos colonócitos (Roediger, 1990). Em gatos seu papel estimulante sobre a contratilidade da musculatura longitudinal e circular do cólon tem sido estudada para estimar a necessidade de fibra alimentar (Rondeau, 2003). Apesar do curto cólon dos gatos a fermentação da fibra alimentar seria uma das formas de fornecer ácidos graxos de cadeia curta, já que via dieta provavelmente não chegariam intactos ao cólon.

1.3.2 Ácidos graxos de cadeia média

Ácidos graxos de cadeia média apresentam cadeias de 6 a 12 carbonos sem insaturações, ou seja, compostos de cadeias retilíneas. São encontrados facilmente nos produtos derivados do leite, especialmente o leite de cabra, cuja espécie prestou seu sufixo para a denominação da maior parte dos AGCM (ácido capróico (6C), ácido caprílico (8C), ácido cáprico (10C),

ácido láurico (12C). A gordura de coco também é fonte destes ácidos graxos, embora cerca de 50% da gordura seja de ácido láurico.

Triglicerídeos de cadeia longa (TCL) se diferem dos triglicerídeos de cadeia média (TCM) por serem compostos por ácidos graxos com mais de 14 carbonos. O baixo peso molecular dos AGCM quando comparado ao dos AGCL confere a eles maior hidrossolubilidade, facilitando o processo digestivo, sua absorção e transporte ao fígado, tornando a digestão e a absorção mais rápidas e fáceis (Back & Babayan, 1982). Sob a ação dos sais biliares e da lipase pancreática, os triglicerídeos contendo AGCM são transformados nas unidades absorvíveis: ácidos graxos livres e monoacilglicerol, que prontamente são absorvidos (Bach et al., 1996). No enterócito, os AGCM não são re-esterificados como ocorre com os AGCL, pois a enzima Acil-CoA sintetase possui mais afinidade pelo AGCL do que pelo AGCM Assim, a maior parte dos produtos da digestão de TCM vão diretamente à via portal, seguindo em direção ao fígado ligados à albumina (Bach & Babayan, 1982; Bach et al., 1996; Papamandjaris et al., 1998). Os AGCL são geralmente esterificados e incorporados nos quilomicrons e então entram nos dutos linfáticos em direção ao ducto torácico. Dessa forma atingem primeiramente a circulação periférica e não diretamente a hepática como fazem os AGCM (Papamandjaris et al., 1998). No fígado, AGCM podem seguir várias vias catabólicas incluindo beta, ômega e a oxidação peroxisomal ou podem ser elongados para formar outros ácidos graxos (Jones et al., 2006).

O metabolismo celular dos AGCM é também bastante específico. Nos tecidos, são normalmente independentes de carnitina para entrar nas mitocôndrias (Friedman et al., 1990), embora alguns estudos com o ácido láurico (C12:0) demostram que uma pequena porção deste ácido graxo pode estar associado à carnitina para acessar a matriz mitocondrial (Christensen et al., 1989; Rossle et al., 1990). Dentro da mitocôndria a maioria dos lipídeos é catabolizada pela beta-oxidação. Os AGCM que não são metabolizados pelo fígado normalmente não são incorporados nos triglicerídeos, fosfolipídeos ou frações de ésteres de colesterol, uma vez que a enzima Acil-CoA sintetase é mais ávida por ácidos graxos com mais de 14 carbonos, havendo menor preferência pela esterificação dos AGCM,como resultado pouco AGCM é recuperado nos triglicerídeos, nos fosfolipídeos, assim como em vários tecidos (Papamandjaris et al., 1998).

Em função deste metabolismo particular, os TCM podem ser ferramenta para melhorar a nutrição em casos específicos. Os TCM podem ser utilizados em síndromes de malabsorção, má digestão, assim como em insuficiência pancreática exócrina, linfangectasia ou quilotórax (Nelson & Couto, 1992). Alguns efeitos dos TCM sobre a obesidade tem sido investigados: sabe-se que o valor energético dos TCM é mais baixo do que o dos TCL e esses parecem levar ao aumento da taxa metabólica pós-prandial (Papamandjaris et al., 1998). Neste caso a inclusão destes ácidos graxos poderia ser útil para formular dietas destinadas a redução de peso ou para manter saudáveis os animais que já foram submetidos a programa de emagrecimento. Uma revisão sobre TCM relatou os efeitos benéficos da

infusão parenteral de AGCM sobre o sistema imune (Wanten & Naber, 2004). Neste caso a inclusão de AGCM foi proposta em substituição a uma porção do AL, reduzindo desta forma a proporção entre AL e ALA.

Recentemente, a utilização de TCM em pacientes portadores de doenças cardíacas demonstrou melhorar o *status* de energia do coração e a assim sua função contrátil (Labarthe et al., 2008). Nenhum efeito tóxico foi observado em diversos estudos em seres humanos ou animais, mesmo quando administrado oral ou parenteralmente ou quando consumido como suplemento de dietas equilibradas, em concentrações de até 15% da energia dietética (Traul et al., 2000). No entanto, o potencial dos TCM pode ser contraposto pelo fato de que sua inclusão pode causar aversão alimentar. Alguns autores demonstraram que cães e gatos não consomem dietas com TCM. Gatos prontamente recusam o alimento quando o ácido caprílico (8:0) é incluído na composição da dieta (MacDonald et al., 1985). Também foi observado aumento nos lipídeos plasmáticos em cães alimentados com AGCM (Van Dongen et al., 2000). A menor palatabilidade dos óleos contendo TCM tem sido observada por muitos autores em diferentes espécies (Lewis et al., 1987; Hill, 1994; Hand et al., 2000). Os gatos recusaram prontamente o alimento demostrando alta sensibilidade à inclusão de 0,1% de ácido caprílico e 5,0% de inclusão de TCM contendo ácido caprílico purificado (MacDonald et al., 1985). Em cães alimentados com dietas purificadas contendo 22% da EM na forma de TCM o consumo foi afetado negativamente e a concentração dos lipídeos plasmásticos aumentou (Van Dongen et al., 2000). Entretanto, quando os cães foram alimentados com 11% da EM na forma de TCM, nenhuma

recusa foi vista e um pequeno aumento no coeficiente de digestibilidade da gordura foi observado. Os triglicerídeos plasmáticos (TG) foram aumentados em 23% nos animais que receberam 11% da EM na forma de TCM em comparação ao grupo de controle (Beynen et al., 2002).

Dietas utilizando fontes naturais de triglicerídeos podem agir diferentemente na aceitação de ácidos graxos pelos animais. Existem 3 formas de se encontrar ácidos graxos de cadeia média: forma pura, como ácidos graxos livres, ácido caprílico purificado (C8); forma de triglicerídeos puros, na qual há uma esterificação artificial dos ácidos graxos de mesmo tamanho nas posições sn-1, sn-2 e sn-3 do glicerol formando o tricaproin, tricaprilin, tricaprin, trilaurin (Ulrich et al., 1996); triglicerídeos naturais originários de fontes que naturalmente contém AGCM, como o óleo de coco e a gordura do leite. Nestes triglicerídeos, no entanto, os ácidos graxos que o compõem não são exclusivamente de cadeia média, podendo haver em algumas posições do glicerol AGCL (Wanten & Naber, 2004).

Os trabalhos analisados foram conduzidos através da utilização de dietas purificadas para alimentar cães e gatos. Na maior parte dos experimentos os pesquisadores utilizaram triglicerídeos purificados e ácidos graxos livres, não fontes naturais de gordura.

1.3.3 Ácidos graxos de cadeia longa

Ácidos graxos de cadeia longa podem ser saturados, monoinsaturados ou poli-insaturados. Os ácidos graxos ditos essenciais são poli-insaturados, com mais de 18 carbonos e com duas ou mais ligas duplas.

Dentre estes ácidos graxos essenciais duas séries se destacam: ômega 3 e ômega 6 (n-3 e n-6) (Gurr et al., 2002).

1.3.3.1 Proporção entre ácidos graxos

De acordo o NRC (2006), nos últimos anos houve intensa discussão a respeito das relações entre ácidos graxos poli-insaturados de cadeia longa, ômega 3 e 6. No entanto, não há consenso entre os trabalhos e esses são difíceis de serem comparados, já que há confundimento dentro dos desenhos experimentais. Vegetais, de uma forma geral, fornecem ácidos graxos essenciais que iniciam as séries, o AL e o ALA, em diferentes proporções. Ingredientes de origem animal são mais completos e fornecem a maior parte dos ácidos graxos de ambas as séries: AL, ALA, AA, EPA, DHA. No entanto, quando se fala de gorduras derivadas de fontes marinhas, a concentração de derivados da série 3 é bastante expressiva, especialmente o DHA. Sabe-se que a adição de fontes marinhas às dietas não pode ser comparada ao aumento de fontes vegetais, porque as fontes marinhas já trazem ácidos graxos mais longos que não necessitam metabolização para causar efeito, pois já estão prontos. Assim, as relações entre ácidos graxos são estabelecidas das mais variadas formas nos diferentes experimentos: somente entre AL e ALA; entre o somatório de todos os componentes de cada série; entre AA o somatório entre EPA e DHA. Dessa forma, comparações entre proporções de ácidos graxos se tornam difíceis. Existem, ainda, particularidades entre os ácidos graxos das séries que precisam ser revistas: a série 6 é considerada geradora de eicosanóides, prostaglandinas e tromboxanos pró-inflamatórios; a

série 3 é geradora de mediadores opostos destas vias, sendo considerados anti-inflamatórios. No entanto, o GLA e o ácido dihomo-γ-linolênico (DGLA) da série 6 são mediadores da produção de prostaglandinas da série 1 e tromboxanos da série 3, com características anti–inflamatórias, mas também são precursores do AA, conhecido como precursor da prostaglandinas e tromboxanos da série 2 e leucotrienos da série 4, altamente inflamatórios. O fornecimento, via dieta, de diferentes ácidos graxos da mesma série, como AL, GLA ou AA, apresentam potencialidades diferentes entre si. Isso significa que a mesma inclusão dietética de diferentes ácidos graxos resulta em respostas diferentes pelo animal (NRC, 2006).

Na nutrição de animais de companhia conhecer detalhadamente estas relações seria importante para atuar na modulação do sistema imune, no entanto as relações entre as duas séries deixam de ser claras à medida que o confundimento entre experimentos ocorre. Atualmente, no estudo dos ácidos graxos, como ocorreu no estudo das proteínas e dos carboidratos, testar a unidade funcional deve ser o objetivo principal. Dessa forma, lipídeos passam a ser estudados na forma de ácidos graxos individualizados. Nem mesmo as divisões entre ácidos graxos de acordo com o seu carbono ômega parecem ser adequadas em muitas circunstâncias. No entanto, é sempre importante lembrar que ambas as séries compartilham das mesmas enzimas e a proporção entre ácidos graxos pode ter efeito indutivo de síntese através do substrato (Gurr et al., 2002).

1.3.3.2 Metabolismo de ácidos graxos da série 6 em felinos

O metabolismo ácidos graxos poli-insaturados em felídeos é bastante curioso e desperta a atenção de pesquisadores desde a década de 70, quando Rivers et al. (1975), a partir da análise de amostras de fígado, descobriram que gatos não possuíam a enzima Δ6 desaturase. Em mamíferos a conversão do AL para AA, assim como a conversão de ALA para EPA necessitam da ação da Δ6 desaturase seguida por uma elongase e então uma Δ5 desaturase (Sinclair, 1979), metabolismo este que estaria prejudicado em gatos mediante a descoberta da deficiência enzimática. Ainda no início das pesquisas, foi notado que gatos privados de ácidos graxos essenciais apresentavam a formação de um ácido graxo identificado como 20:3 n9 (Holman, 1970). O acúmulo deste ácido graxo também foi observado quando animais foram alimentados com gordura animal hidrogenada (Sinclair, 1981), embora o grupo de Rivers et al. (1976ab) não tenha relatado a presença deste ácido graxo em gatos recebendo dietas deficientes em ácidos graxos essenciais (Rivers et al., 1976ab).

O 20:3 n9, por sua vez, poderia ser formado pela ação da mesma cascata enzimática responsável pela conversão do AL em AA agindo sobre o 18:1 n9, que por sua vez seria gerado a partir do 18:0 pela ação da Δ9 desaturase (Figura 1). Dessa forma, alguns autores levantaram a hipótese de que Δ6-desaturase deveria estar presente para a formação de 20:3 n9 e que alguma produção de AA poderia ser possível (Sinclair et al., 1981; Rivers et al., 1981). Sinclair et al., (1979; 1981) sugeriram uma via alternativa para a

produção de 20:3 n9, independentemente da Δ6 desaturase (Figura 1). De acordo com esta hipótese, o AA poderia ser formado pela mesma via, sem a participação da enzima Δ6 desaturase, mas com a atuação de uma Δ8-desaturase (Mclean & Monger, 1989). A enzima Δ8-desaturase está presente nos testículos de ratos e é responsável por converter o AL em AA (Albert & Consiglio, 1977). O mesmo metabolismo foi descrito na bexiga e no cólon humano (Nakazawa et al., 1976).

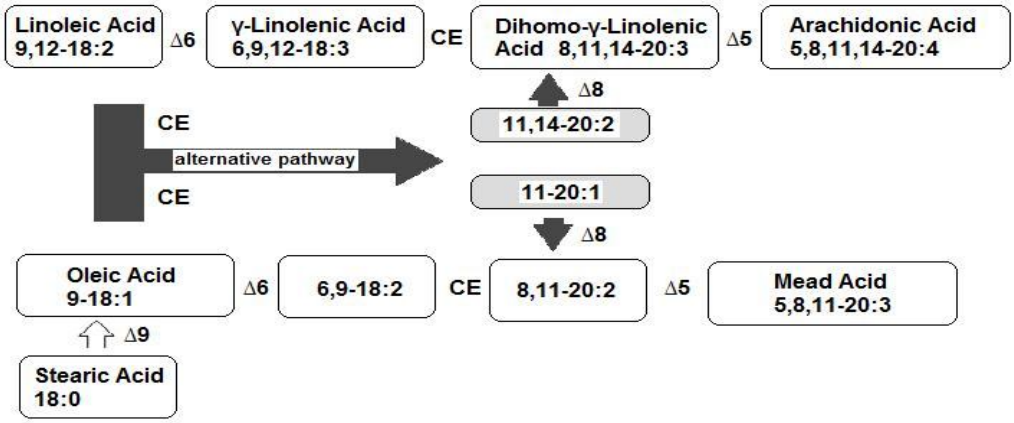

Figura 1– Via normal de síntese de AA e *Mead acid* está representadalinearmente. A via alternativa está representada por setas em cinza. Ácido Linoleico e Ácido Oléico sofrem primeiramente a ação da enzima carbono elongase (CE) e então Δ8 and Δ5 desaturase para formar AA e *Mead acid*. (Adaptado de Sinclair et al., 1979).

Isto significa que na presença da Δ8 e da Δ5-desaturase, o AA poderia ser produzido, apesar de não haver atividade da Δ6-desaturase. Mas quando [1-^{14}C] 18:2 n6 foi incluído na dieta, nenhuma evidência foi encontrada de síntese de AA (Sinclair et al., 1979). Entretanto, quando administrado [2-^{14}C]

20:3 n6, houve significativa produção de AA, sugerindo que gatos possuem Δ5-desaturase ativa (Sinclair et al., 1979).

A sintomatologia de pele seca, perda de pelo, infertilidade e infiltração de lipídeos no fígado foram conhecidas quando gatos foram privados de ácidos graxos essenciais na dieta (Hassam et al., 1977; Rivers et al., 1976a,b; Frankel & Rivers, 1978; Rivers, 1982). Foi demonstrado que devido à deficiência enzimática, os sintomas de infertilidade não são revertidos mesmo com a adição de AL e ALA (MacDonald et al., 1983, 1984). Os mesmos autores notaram que gatos recebendo AL possuíam maior concentração de AA nos testículos e que fêmeas foram incapazes de conceber quando alimentadas somente com AL.

Recentemente foram testadas dietas isentas de AA e suplementadas com óleo de milho a 1%, 3% e 1% acrescido de 0,02% de AA (Pawlosky & Salem, 1996). Fêmeas foram alimentadas antes de serem cruzadas com os machos e durante toda a gestação. Todas as fêmeas ciclaram normalmente e emprenharam, no entanto, as fêmeas que receberam dieta com apenas 1% de óleo de milho tiveram ninhadas com alta incidência de defeitos congênitos e baixa viabilidade quando comparadas aos demais grupos. Mas as fêmeas suplementadas com 3% de óleo de milho tiveram ninhadas normais. Concluiu-se que fêmeas são incapazes de reproduzir normalmente quando mantidas em dietas muito baixas em AGE, mas um pequeno acréscimo de AA é capaz de reverter essa situação. A dieta com 3% de óleo de milho e sem AA atendeu normalmente às necessidades das fêmeas sendo concluído que outros fatores

dietéticos poderiam estar envolvidos. Num estudo adicional, Pawlosky et al. (1997), com as fêmeas filhas das mães utilizadas no experimento anterior, demonstraram acúmulo de carbono marcado no AA a partir de AL.

Morris et al. (2004), descreveram que gatos mantidos em dietas com AL e livres de AA são férteis, concluindo que AA não é essencial para machos em reprodução. As fêmeas alimentadas no mesmo sistema tiveram todo o processo reprodutivo normal, no entanto, após o parto houve uma alta incidência de canibalismo sobre a ninhada, logo após o nascimento. Após este experimento as fêmeas foram separadas em dois grupos e receberam uma dosagem diária de AA de 0,5 ou 1 ml de AA concentrado a 40,7% e após 10 semanas foram cruzadas com machos novamente. Nenhuma das fêmeas concebeu, sendo concluído que algum outro ácido graxo pode estar envolvido no processo reprodutivo sozinho ou associado com o AA. Quando o óleo contendo GLA (18:3n-6) foi adicionado à dieta, os problemas reprodutivos melhoraram. O GLA pode ter melhorado o nível de AA já que é o produto pré formado da ação da Δ6 desaturase (Rivers & Frankel, 1980). Estes estudos têm servido de suporte até hoje para o conceito de que gatos necessitam de AA preformado, pois a enzima Δ6 desaturase possui baixa ou inexistente atividade em gatos.

No entanto, ainda há a possibilidade de que o AA possa ser produzido a partir das enzimas $\Delta 8$ and $\Delta 5$ desaturase (Sinclair et al., 1981). Dessa forma, apesar da não atividade da Δ6 desaturase, alimentando gatos com dietas ricas em AL poderia induzir uma vai alternativa para a produção de

AA. Da mesma forma, o GLA seria uma forma fácil de fornecer precursores para a síntese de AA.

1.4 Métodos de pesquisa em lipídeos

O estudo da composição dos lipídeos nos tecidos dos animais pode ser uma forma de se evidenciar alterações dietéticas e patológicas em animais. Os fosfolipídeos, por sua vez, com suas diferentes classes podem revelar ainda mais a respeito do metabolismo celular envolvendo ácidos graxos e os produtos de sua degradação. Dessa forma, o estudo dos fosfolipídeos mediante sua composição de ácidos graxos pode ser uma forma de se estimar como os componentes dietéticos alteram a formação destes compostos (Ivanova et al., 2004).

Os métodos para análise de lipídeos estão baseados na solubilidade das substâncias. A metodologia segue uma série de passos para a extração e separação das porções lipídicas desejadas (Christie, 2001). A extração dos lipídeos a partir de tecidos, animal ou vegetal, é feita de acordo com o método de Folch (1957), no qual a matéria a ser analisada é submetida a extração de lipídeos totais pelo contato do tecido a ser analisado com uma mistura de álcool e clorofórmio. Os lipídeos extraídos podem ser analisados na forma total ou submetidos à separação das diferentes porções: tecidos animais como membranas de células possuem basicamente fosfolipídeos e colesterol. O plasma, além destes dois componentes ainda apresenta ácidos graxos livres e triacilgliceróis.

Os métodos de cromatografia em camada delgada são indicados para a separação de componentes dos lipídeos totais. Devido à polaridade, misturas de clorofórmio, álcool e ácido acético separam as porções nos diversos componentes através do arraste das substâncias mais apolares ao longo de uma camada de sílica (Touchstone, 1995).

Os próprios fosfolipídeos totais podem ser separados nas suas porções componentes pelo mesmo método somente se alterando a composição e a proporção entre os solventes. Os fosfolipídeos, por sua vez, podem ser derivatizados para a análise de composição de ácidos graxos por cromatografia gasosa (Wang & Gustafson, 1992; Homan & Anderson, 1998; Lesnefsky et al., 2000; Kim et al., 2000). De uma forma geral, estes métodos são bastante onerosos, consomem muito tempo e são capazes de detectar um limitado número de componentes.

A utilização de técnicas mais modernas como espectrometria de massa confere maior sensibilidade, especificidade e rapidez à análise de lipídeos. No início o *fast atom bombardment* (FAB-MS) permitiu gerar um abundante número de íons não fragmentados juntamente com alguns fragmentados (Matsubara & Hayashi, 1991; Murphy & Harrison, 1994) os quais permitiram encontrar informações adicionais e revelaram um grande potencial para o *Tanden MS* (MS/MS – análise de moléculas e fragmentados ionizados a partir de compostos lipídicos). Lipídeos termolábeis e não voláteis podem ser analisados através de *Soft Ionization*, por um método denominado *matrix-assisted laser desorption/ionization* (MALDI) (Schiller et al., 1999) e ionização

por *eletrospray* (ESI) (Fenn et al., 1989; Weintraub et al., 1991), os quais não causam extensiva fragmentação dos compostos. Esta pode vir a ser uma ferramenta disponível para a análise direta de fosfolipídeos e seus ácidos graxos que dentro de uma mistura complexa podem ser correlacionados com as condições experimentais ou com doenças.

1.5 Hipótese e objetivos

O presente trabalho foi dividido em dois estudos. O primeiro trabalho visou esclarecer se os gatos aceitam dietas contendo óleo de coco rico em ácidos graxos de cadeia média em substituição a dieta com óleo de açafroa (*Carthamus tinctorius*) rico em AL, e se ocorreriam efeitos negativos sobre o metabolismo lipídico. O segundo estudo foi baseado na adição de óleo de borragem (*Borago officinalis*) na dieta, com vistas a elucidar os seguintes pontos: se os gatos são capazes de produzir AA a partir de GLA consumido; se a enzima Δ6 desaturase está realmente inativa, mediante a adição de ácido linoléico em alta concentração; se existe uma rota alternativa para produção de AA a partir do AL.

As hipóteses estabelecidas foram as seguintes:

Gatos consomem AGCM quando estes são provenientes do óleo de coco e incluídos na concentração de 11% da EM da dieta.

Gatos são capazes de produzir AA quando o produto da Δ6 desaturase sobre o ácido linoléico, o GLA, é oferecido pré-formado via dieta, pois a enzima Δ5 desaturase está presente e é ativa.

A síntese de AA pode ser possível através de uma via alternativa, não utilizando a Δ6 desaturase, mediante o acréscimo de ácido linoléico à dieta em altas concentrações.

CAPÍTULO II[3]

[3] Artigo formatado conforme normas do *American Journal of Veterinary Research.*

Dietary medium-chain triglycerides cause no food aversion in cats and have minimal effects on plasma lipids and lipoprotein distribution.[1]

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[6] Abbreviations used: MCT, medium-chain triglycerides; ME, metabolic energy; LA, linoleic acid; BW, body weight; BCS, body condition score; TG, plasma triacylglycerol; TC, total cholesterol; LP-C, lipoprotein cholesterol distributions.

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Objective – To determine possible diet aversion and lipid and lipoprotein alterations in cats fed diets containing medium chain triglycerides.

Animals - Nineteen clinically normal, adult female cats were randomly assigned into two groups (low medium chain triglyceride (MCT) diet, n=10; and high MCT diet (at 11% ME MCT, n=9) and fed for 9 weeks.

Procedures - Cats were fed according to their metabolic body weights (100 kcal ME*$Wkg^{0.67}$ day^{-1}). Daily consumption records, weekly body weights (BW), and body condition scores (BCS, 1 to 9 scale where 5 is ideal) were used to adjust amounts fed and to calculate daily metabolic energy factors for each cat to maintain an ideal BCS. Blood samples were obtained after withholding food at d 0, 14, 28 and 56 for plasma triglyceride (TG), total cholesterol (TC), and lipoprotein cholesterol distribution (LP-C).

Results - Repeated measures ANOVA and Tukey (α=0.05) multiple comparison tests revealed no differences between diets with respect to food consumption, BW, BCS, and metabolic energy factors. A statistically significant increase in plasma TG was seen with the HMCT diet; however values were within the normal feline range. No diet effects were seen on TC or LP-C although increases over time were observed.

Conclusions and Clinical Relevance – Results of this study demonstrate that it is feasible to include MCT in normal feline diets without refusal in the amounts fed with minimal effect on lipid metabolism. Such diets appear to be useful for not only clinically normal cats and may have utility in metabolic disorders. The MCT oils are thus an example of a bioactive dietary lipid that may benefit feline metabolism and can serve as a useful functional food ingredient for feline species.

Introduction

Medium chain triglycerides (MCT) are readily found in products such as coconut oil and milk by-products. They consist of 8 to 12 carbon atoms with no double bonds. By contrast long chain triglycerides (LCT) typically contain ≥14 carbons and may be either saturated or unsaturated. Because of their low molecular weight and higher water solubility compared with LCT, MCT are more readily digested and absorbed resulting in their more rapid transport to the liver via portal circulation.[1] During digestion, the smaller molecular weight of MCT compared to LCT facilitates the action of pancreatic lipase enabling the ready release and absorption of free fatty acids and monoacylglycerol.[2] After absorption, triacylglycerol are re-esterified by Acyl-CoA synthetase but this enzyme has greater affinity for LCT than MCT. Consequently, a major portion of absorbed MCT are directly enter the portal venous circulation, are bound to albumin, and transported directly to the liver.[1-3] By comparison, LCT fatty acids are typically resynthesized into triacylglycerols, incorporated into chylomicrons, and transported via the lymphatic system to the thoracic duct; initially bypassing the liver.[3] Once in the liver, medium-chain fatty acids (MCFA) may follow various catabolic pathways including beta-, omega-, and peroxisomal oxidation or elongation to other fatty acids.[4] In tissues, transfer of MCFA into mitochondria for beta-oxidation is normally carnitine independent.[5] However, some studies using 12 carbon fatty acids (C12:0) showed that carnitine transport may provide at least a minor pathway for C12:0 metabolism.[6,7] Although the bulk of fatty acid (FA) catabolism occurs via mitochondrial beta-oxidation, triacylglycerol re-esterification may also occur via FA synthetase. However, this latter pathway is more effective with FA of ≥14 carbons than with MCFA. Consequently, few dietary MCFA

are recovered *per se* in triacylglycerol, phospholipids, or cholesterol ester fractions of plasma or tissues.[3]

Because of their unique metabolism, dietary MCT supplementation may be beneficial in several respects. For example, MCT may be used in malabsorptive and maldigestion disorders as well as exocrine pancreatic insufficiency, lymphangiectasia, or chylothorax.[8] Some effects of MCT have also been explored in obesity management because the energy content of MCT is less than LCT and postprandial energy expenditure increases when MCT are used.[3] Thus, diets containing MCT may help during weight reduction and for health maintanence thereafter. Other possible benefits of MCT oils include effects of parenteral infusion on the immune system and improvement of cardiac energetics and contractile function in certain cardiac disorders.[9,10] In addition no toxicologic effects of MCT oils have been reported in several studies of both humans and animals whether administered orally or parenterally or if consumed as a supplement to a balanced diet at levels up to 15% of energy.[11] In spite of these potential benefits, some authors have reported food aversion with MCT diet inclusion in dogs and cats. This effect was especially pronounced when caprylic acid (C8:0) was fed.[12] Also, poor palatability of various MCT oils have been reported by several authors.[13-15] In cats, aversion was seen at 0.1% inclusion of C8:0 fatty acid and 5.0% MCT containing purified C8:0.[12] In dogs, purified diets containing 22% ME MCT depressed consumption and increased plasma lipid concentrations.[16] However, when dogs were fed 11% ME as MCTs, no refusals were seen and a slight increase in crude fat digestibility was observed. Also, plasma triacylglycerol concentrations increased by 23% in the groups which received MCT compared to control.[17] It is important to note, however, that the previous studies all used purified diets. The present study was conducted using natural source ingredients

by replacing safflower oil with coconut oil to achieve an 11% ME MCT inclusion in a complete and balanced diet. Acceptance of this diet as well as its possible effects on feline lipid metabolism was investigated. The objective was to feed the diets to achieve and maintain normal body weights of cats and equalize their metabolism at steady state while achieving body condition scores of 5 out of 9.

Materials and Methods

Animals and diets. Nineteen adult, sexually intact female cats ranging in age between 1.5 to 2 years with body weights between 2.4 and 6.0 kg were used. Expect for three cats, the animals had body conditions score (BCS) of 5-6 out of 9, with 5 considered ideal. These initial scores were determined during a 4 week pre-experimental diet period and prior to starting the feeding study. One of the animals scored a BCS of 8 while the other two were BCS of 7 each and all appeared more resistant to BCS lowering than the other cats. Scoring of cats was performed by the same individual each time (LT) to minimize variation and observer bias during the course of the study. Cats were individually maintained in kennels according to the American Physiological Society Guidelines for Animal Research, and the protocols were approved by Texas A & M University Animal Care and Use Committee. The cats were assessed to be clinically normal prior to entering the study as indicated by complete blood counts, serum biochemistry profiles. T3 and TSH tests, and physical examination by one of the authors (LT) and all findings were within normal limits.

The cats consumed a pre-experimental diet (PED) for 4 weeks prior to the start of the trial and were fed the experimental diets for 9 weeks. The PED was a commercially available extruded dry cat food that was complete and balanced. It was purchased locally and contained 30% (minimum) crude protein, 8% (minimum) crude fat, 4,5% (maximum) crude fiber, and 12% (minimum) moisture.[a] During the PED period, cat body weights and BCS were determined weekly and food consumption was determined daily. Cats were fed in the morning and all animals consumed their ration quickly, usually within the first hours after feeding. All cats fed according to their individual metabolic weights (100 kcal * $Wkg^{-0,67}$/day). [18] Modifications of amounts fed were made, where necessary to maintain each animal's weight at a BCS of 5/9.

They were stimulated every week to play with paper bags to have some physical activity. The measured amounts of diet fed and physical activity helped control the cat's body weights for the most part. As noted above, three of the animals appeared resistant to BCS lowering. Nonetheless, all cats were randomly assigned to two groups according to diet fed: High MCT (HMCT, n=9) and Low MCT (LMCT, n=10). The cats were fed these diets again using their individual weekly metabolic weights (100 kcal ME * $Wkg^{-0,67}$/day) to maintain the BCS of 5 out of 9. [18]

The experimental diets were formulated to be complete and balanced to meet or exceed minimal nutrient requirements for adult cats. [19,20] They were manufactured as dry, extruded products by Nestlé Purina Product Technology Center (St Louis, MO, USA). These two diets were similar in all respects except for fatty acid type vary only in relative amounts of coconut oil, rich in MCT, and safflower oil, rich in linoleic acid (**Table 1**). The fatty acid profile of the PED is also shown (**Table 1**).

The expected nutrient compositions of the experimental diets were: 35% protein, 18% fat (acid hydrolysed), 7,5% ash, 8% moisture, and 2% crude fiber. After manufacture, the diets were analyzed by Nestlé Purina Analytical Laboratories and found to be within expected analytical variance of these targets (**Table 2**).

During the experimental period, the animals were fed once a daily. Food consumption and Body Maintenance Energy Requirement ((BMR) in kcal ME $kg^{-0,67}$/day) were recorded after 24 hours and averaged by week for statistical analyses. Based on weekly weight evaluations, it was necessary to reduce caloric intake to 80 kcal ME * W kg0,67 in the three cats that began the study at BCS of 7-8 because appeared resistent to BCS lowering when fed at the recommended amounts fed the other cats.

Sample collection and analysis. Blood samples were obtained from each cat by vena puncture at weeks 0, 2, 4 and 8 during the experimental periods. Food had been withheld for 12 hours and 7 ml of blood were drawn from a saphenous vein into EDTA-containing tubes. At week 0, complete blood counts and plasma biochemistry profiles were evaluated. Blood samples were centrifuged at 2800 rpm for 15 minutes and plasma was separated in small aliquots and frozen at -80^{o}C. Triglycerides and total cholesterol (TC) concentration determinations were performed using enzymatic methods.[21] Lipoprotein cholesterol distributions (LP-C) were determined using fresh plasma by electrophoresis on 1% agarose, stained and quantified by scanning densitometry, and results presented as β, pre-β, and α LP-C fractions.[21]

Digestibility assay. All cats were submitted to a digestibility study during week 6. The cats' feces were individually collected twice a day for 5 consecutive days and frozen at -20 C. All samples, including feces and diets, were sent to the Nestlé Purina Petcare Laboratory for analysis. Parameters evaluated were coefficient of digestibility from crude protein, total fat, crude fiber, ash, and gross energy measurements. The coefficient for digestible energy (DE) was calculated and metabolizable energy was calculated based on DE and urinary loss.[20]

Statistical methods. Values presented are means $\pm$ SEM. All data except for the normative BCS data were found to be normally distributed by Shapiro-Wilks test. The BCS were analyzed by the nonparametric test, Kruskal-Wallis one-way ANOVA (SAS 9). Digestibility coefficients were compared between diet, time, and diet x time interactions and tested using Proc GLM ANOVA by SAS ($P<0.05$). For the other data, statistical significance was determined using repeated measures ANOVA for diet, time, and diet x time interactions for plasma parameters (TG, TC, LP-C fractions), food consumption, body weight, and metabolic factor using Proc Mixed by

SAS ($P < 0.05$). For all parameters Tukey's multiple comparison of means was performed where appropriate.

Results

Energy Consumption. For the most part, all cats readily consumed all diets at the time they were offered and all diets were consumed within 4 hours. No diet refusals were observed with either the HMCT or LMCT diets, although two cats consumed a smaller number of calories than was fed compared to the other animals. No diet effects were observed during the study and total energy consumption or amounts of food consumed per week were also not different (P=0.9444). It should be noted, however, that a significant time effect on weekly energy consumption was seen between week 0 and weeks 5 and 7 (Figure 1). Although the energy densities of the experimental diets were approximately equal, the PED had less energy per kg than the experimental diets (3.200 kcal kg^{-1} calculated).

Body weight and Body Condition Scores. The cats showed a modest weight loss (time effect) between week 0 to week 8, (P=0.0257), but this difference was not statistically significant between the diets (P=0.5953) (Figure 1). Although some of the cats began the study at BCS of 7-8, all but one had reached the desired BCS (5-6/9) by the end of the experimental period and this animal had a BCS of 7/9. No significant differences between diets (P=0.2696) and no time effects were observed (P=0.0572) during the study. All animals were again assessed by physical exam and laboratory blood profile analyses found to be clinically normal at the end of the study (data not shown).

Maintenance Energy Requirement. No difference was observed between the diets with respect to energy needed to meet the animals' maintenance energy requirements (P=0.5751). Furthermore, energy requirements were stable throughout the study even

though a statistically significant difference was observed when week 0 was compared to the subsequent periods (P<0.0001) (Figure 2).

Plasma Lipid Parameters. A significant time effect was observed on plasma cholesterol concentrations for all cats beginning at week 2 with a maximal elevation seen at week 4. However, no diet differences were observed (P=0.7813). The *α-LP-C* fraction was similarly elevated over time and was increased 67% on week 4 *vs* week 0. This fraction was responsible for most of the total plasma cholesterol elevation although the other LP fractions also contributed to a lesser extent to this increase over time (Table 3). The *Pre-β-LP-C* followed a similar pattern with a maximal value achieved at week 2 but decreasing until week 8 to the same concentrations found at week 0 (P=0.0003). However, a diet x time interaction was seen in this fraction (P=0.0348, Table 4). In this case, cats fed the HMCT diet showed increased *pre-β-LP-C* vs the LMCT diet at week 4, returning to basal levels at week 8. The *β-LP-C* also increased but remained elevated at week 8 unlike the other LP-C fractions.

Both time (P=0.0156) and diet (P=0.0234) effects on plasma TG concentrations were observed (Table 3). Feeding the HMCT diet resulted in higher TG concentrations vs. the LMCT diet. Time effects included a maximal increase of plasma TG at week 4 which decreased to its initial concentration at week 8.

Digestibility assay. No significant effects were found for any parameters tested (data not shown) although apparent total fat digestibility was numerically higher for HMCT diet (HMCT=93.22% and LMCT=92.12%) (P=0.3067).

Discussion

This work is the first to report that cats will readily consume MCT containing diets without refusal. This finding is in contrast to several earlier studies in cats and other species that observed feed refusal when MCT was included in the diets.[13-15] It should be noted that dietary oils containing MCT have no unpleasant odors or taste, *per se*. By contrast, MCFA in their non-esterified form may have an objectionable flavor or odor often associated with goats.[22] It should also be noted that most of the earlier reports used higher inclusion amounts of either MCT or nonesterified MCFA, typically ≥ than 22% ME. Another important factor for consideration is the type of MCTs fed. In some studies, purified triglycerides like tricaproin (6:0 C), tricaprylin (8:0 C), tricaprin (10:0 C) and trilaurin (12:0 C) were investigated[9] while in the present study, mixed MCTs from coconut oil were used.

One important objective of the present work was to verify acceptance of practical diets containing MCT oils by cats. For this reason coconut oil was used as a source of MCT. Coconut oil contains approximately 50% of total fat as MCT while LCT comprises the other fatty acid portion. This blend of fatty acids is most likely the reason for acceptance by cats in this study compared to purified MCT oils fed exclusively. In dogs, diets containing 11% MCT were also readily consumed and with increased crude fat digestibility.[17]

It is unknown why feed refusal occured in cats fed purified MCT. However, some properties of these dietary triglycerides may affect palatability. Diets containing free MCFA (0.1% caprylic acid (C8:0)) were refused by cats presumably due to an objectionable taste as reported by McDonald et al.[12] Because MCT are more water soluble than LCT, they may be more readily released from the triglyceride molecule

in aqueous solution in spite of the absence of lingual lipase in the feline species.[1,3] Thus, the possibility exists that some partial hydrolysis may have occurred in the mouths of cats fed purified MCT leading to MCFA release thereby affecting taste. By contrast, food intake was not affected after intragastric administration of LCT vs. MCT [23] which would eliminate a systemic effect on satiety and food intake. Consequently, the feed refusal seen may be related to physical events occurring in the mouth, oral cavity, or taste receptors.[22] Additionally, triglycerides containing both MCFA and LCFA may have different olfactory properties or hydrolysis patterns which, in turn, may also have some impact on palatability.

Some of cats entered the study at a greater BCS than ideal. In these cases the amount of energy fed was reduced so that they would achieve the desired BCS. Because animal energy requirements are inversely proportional to fat mass, calories needed to maintain fat tissue is much lower than that of lean tissues.[20] The small loss of body weight during the initial week of the study occurred only during adaptation to the experimental diets because the animals received fewer total calories than in subsequent weeks.

The metabolic factor recommended in the National Research Council report on nutrient requirements for adult cats (NRC) was used to initially determine how much to feed the cats in this study (i.e. 100 kcal ME * $Wkg^{-0,67}$ day^{-1}).[20] However, because actual consumption amounts needed to maintain ideal body condition were recorded each day, the actual average metabolic constant could be calculated and compared with the NRC value. As a result, this calculated constant was similar to that reported in the NRC t which helps substantiate current energy recommendations for the feline species.[20] This factor is calculated as the ratio between food consumption and metabolic BW and can used to compare the energy metabolism between diets. It was

helpful in this work because it was used to estimate the amount of daily energy necessary to maintain a BCS of 5/9 and is most useful when it is applied to animals with the same BCS. If not, comparisons are difficult because maintenance energy varies according to the relative amounts of lean and fat mass in each individual.[24]

Regarding lipid metabolic alterations, several studies in humans have reported hypercholesterolemia, especially in low density lipoprotein (LDL) fractions, when MCT are fed compared to LCT.[25,26] Other studies reported an increase in plasma TG concentrations. For example, in dogs, plasma TG concentrations were increased 80% when 22% ME MCT was included in the diet.[16] Dogs fed 11% ME MCT also tended toward TG concentration elevations of 23% but with no effect on the LDL fraction. One study in cats, found a similar effect with a diet containing 11% ME MCT.

Time effects showing plasma TG and TC elevations in the present study are likely related to increase fat contents of the experimental diets compared to the PED. Increased dietary MCT did not appear to modify this effect. While PED contained 12% crude fat on dry matter basis (DM), the LCMT and HMCT diets had 19,9% and 18,2% crude fat (DM), respectively. It should be noted, however, that the TG and TC never exceeded a normal upper limit seen in cats at any time point. It is noteworthy, however that the increase in TG observed with the HMCT diet coincided with an increase pre-β-LP-C (VLDL) fraction. High MCT diets may promote an increase in β-oxidation generating more acetyl-CoA[1] and, during positive energy balance, subsequent stimulation of triacylglycerol synthesis and increased VLDL production.[27] Because there was a slightly higher total fat content in the LMCT diet compared to HMCT, had both diets been equivalent in total fat, it is possible that the TG elevation seen with HMCT may have been even somewhat higher. However, this remains to be determined.

In the present work, TC elevations were specifically associated with *α-LP-C* corresponding to a high density lipoprotein (HDL) fraction. It should be noted that lipoprotein metabolism is unique in both dogs and cats. In humans the fraction that is often associated with hypercholesterolemia is *β-LP-C* corresponding to LDL. However, in dogs and cats, α-LP-C is most frequently increased with hypercholesterolemia and it is this phenomenon which helps protect these species against atherogenesis, coronary artery diseases, and their complications.[27]

Time effects seen on plasma TG and TC are likely related to an increased fat content in the experimental diets compared to the PED. While PED contained 12% crude fat on a dry matter basis (DM), the experimental diets had more than 18% crude fat DM. It should be noted, however, that the TG and TC never exceeded a normal upper limit seen in cats at any time. The increase in TG observed with the HMCT diet appeared to coincide with an increased pre-β-LP-C (VLDL) fraction. High MCT diets may promote an increase in β-oxidation generating more acetyl-CoA[1] and, during positive energy balance, subsequent stimulation of triacylglycerol synthesis and increased VLDL production.[28]

In summary, cats readily consumed an MCT containing diet with no refusal and all animals achieved the ideal BCS at the end of the study. The lesser amount of energy provided by MCT (11% ME as MCT) and natural source of fat (coconut oil - which kind, specie? I don't know, maybe just Wendy can inform us about it) may be reasons for normal consumption of the HMCT diet compared to earlier studies. Coconut oil may thus be considered as an ingredient for inclusion in cat diets. Diets incorporating MCT may also have potential to help manage several disorders of cats associated with lipid metabolism (e.g. malabsorption syndrome) because of its unique digestion and metabolism. While some increases in plasma TG and TC were observed in this study,

none of these changes were found to be in excess of normal limits. MCT oils are thus an example of a bioactive lipid important to help manage several types of metabolic diseases[29] and can serve as a useful functional food ingredient[30] for feline species.

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Figure Legends

Figure 1: Food consumption, kcal ME $week^{-1}$ (LMCT Cons and HMCT Cons, bars) and Body Weight, kg (LMCT BW and HMCT BW, lines) during the 8 week feeding period. Values are mean ± SEM, LMCT diet *n* = 10 and HMCT diet *n* = 9. At each time point, means without a common letter differ, $P<0.05$.

Figure 2: Maintenance Energy Requirement (MER), kcal ME $kg^{-0,67}$ day^{-1}, during the 8 week feeding period. Values are mean ± SEM, LMCT diet *n* = 10 and HMCT diet *n* = 9. At each time, means without a common letter differ, $P<0.05$.

TABLE 1

Experimental diet fatty acid concentration[1]

	Diet		
Fatty acid	HMCT	LMCT	PED
	g/kg dry matter		
6:0	0.40	<0.1	ND[2]
8:0	6.00	2.29	ND
10:0	5.01	2.27	ND
12:0	43.40	16.51	ND
18:2(n-6)	20.80	71.00	15.04
20:4(n-6)	0.35	0.34	0.26
Total saturated	113	68	31
Total monounsaturated	45	55	32
Total polyunsaturated	23	74	16

[1] Values are the means of two determinations performed in duplicate. Values were deemed acceptable when 95% of the absolute differences between duplicates were < 2 SDs of their difference.
[2] Not detected.

TABLE 2

Experimental diet nutrient profile[2]

Nutrient	Diet HMCT	Diet LMCT
	g/kg dry matter	
Crude Protein	349	355
Nitrogen-free extract	378	351
Fiber	20	18
Ash	70	77
Total Fat	182	199
Energy, *ME kcal/kg*[1]	4.330	4.320

[1] Value obtained according to digestibility analysis except for PED which was calculated.

[2] The diets are designated on the basis of their MCT contents (HMCT, high content; LMCT,low content). The dry, extruded-type diets were manufactured by Nestlé-Purina Petcare. Diet ingredients (by weight): Brewers milled rice, 35.9%; Soybean protein isolated, 23.3%; Chicken whole carcass and parts, 21.6%; Soybean hulls, 3.67%; Dicalcium phosphate, 2.93%; Coconut oil, 2.80%; Flavor coating, 1.5%; Beef tallow, 0,7%; Potassium chloride, 0.65%; Mineral premix, 0.34%; Choline chloride, 0.32%; Calcium carbonate, 0.29%; Sodium chloride, 0.22%; DL-methionine, 0.18%; Taurine, 0.1%; Vitamin premix, 0.07%; Vitamin E (50%), 0.03%. Vitamin premix contents: 146.32 g/kg nicotinicacid, 10.35 g/kg vitamin A acetate, 90 g/kg dl-α-tocopherol acetate, 84 mg/kg cholecalciferol, 52 g/kg thiamine mononitrate, 51.06 g/kg calcium D-pantothenate, 24.4 g/kg riboflavin, 14.52 g/kg pyridoxine hydrochloride, 6 g/kg folic acid, 508 mg/kg menadione sodium bisulfite, 93 mg/kg vitamin B-12, and 36.8 mg/kg biotin. Mineral mix contents: 65 g/kg zinc as zinc sulfate, 39 g/kg iron as ferrous sulfate, 18.25 g/kg manganese as manganese sulfate, 3.2 g/kg copper as copper sulfate, 651 mg/kg iodine as calcium iodate, and 50 mg/kg selenium as selenium selenite. The remaining percent of each diet were consisted of two dietary oils: Coconut oil, 5.24% in HMCT diet and Safflower oil, 5.58% in LMCT diet which provided the desired fatty acid profiles.

[3] Kit N Kaboodle® Cat Food, Nestlé Purina Pet Care, St. Louis, MO. Amount of total fat was determined by extraction and gravimetric analysis while ash content is estimated at 7.5%.

TABLE 3

Plasma lipid and lipoprotein-cholesterol concentrations in adult cats fed the experimental diets[1]

	Diet			Time					Diet*Time
Source	HMCT	LMCT	*P* Value	0	2	4	8	*P* Value	*P* Value
	mmol/L			*mmol/L*					
β-LP-C	0.57 ± 0.04	0.62 ± 0.04	0.6776	0.36 ± 0.06^{b}	0.65 ± 0.04^{a}	0.72 ± 0.06^{a}	0.65 ± 0.04^{a}	<0.0001	0.9603
Pre-*β*-LP-C	0.80 ± 0.05	0.70 ± 0.05	0.1137	0.67 ± 0.08	0.93 ± 0.05	0.83 ± 0.06	0.59 ± 0.07	0.0003	0.0348
α-LP-C	2.80 ± 0.18	2.71 ± 0.13	0.8169	2.09 ± 0.14^{c}	2.38 ± 0.13^{b}	3.49 ± 0.21^{a}	3.13 ± 0.22^{a}	<0.0001	0.2330
Total Cholesterol	4.19 ± 0.22	4.06 ± 0.17	0.7813	3.10 ± 0.22^{c}	3.93 ± 0.20^{b}	5.07 ± 0.25^{a}	4.37 ± 0.25^{b}	<0.0001	0.1844
Triglycerides	0.29 ± 0.02	0.24 ± 0.01	0.0234	0.27 ± 0.02^{ab}	0.28 ± 0.02^{ab}	0.29 ± 0.02^{a}	0.24 ± 0.01^{b}	0.0156	0.1121

[1] Values are means ± SEM, HMCT diet *n* = 9 and LMCT diet *n* = 10. Means in the row with superscripts without common letters differ, $P < 0.05$.

TABLE 4

Pre-β-LP-Cholesterol interaction between Diet and Time in cats fed the experimental diets[2]

	Time (week)			
Diet	0	2	4	8
HMCT	0.68+ 0.13^{ab}	0.96+ 0.04^{ab}	0.97+ 0.09^{a}	0.61+ 0.10^{b}
LMCT	0.66+ 0.09^{a}	0.88+ 0.10^{a}	0.66+ 0.06^{a}	0.59+ 0.11^{a}

[2] Values are means $\pm$ SEM, HMCT diet n = 9 and LMCT diet n = 10. Means in the row with superscripts without common letters differ, $P<0.05$.

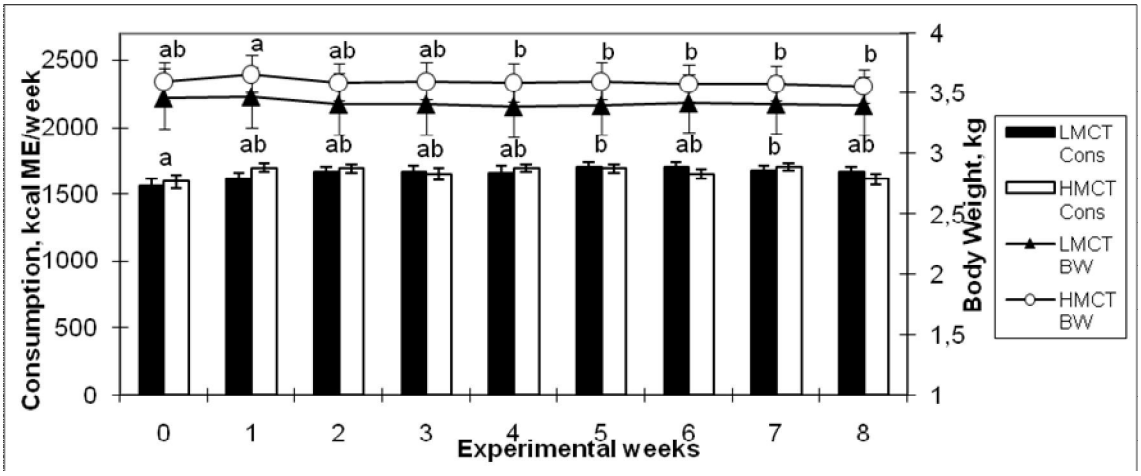

FIGURE 1: Food consumption, kcal ME week^{-1} (LMCT Cons and HMCT Cons, bars) and Body Weight, kg (LMCT BW and HMCT BW, lines) during the 8 week feeding period. Values are mean ± SEM, LMCT diet n = 10 and HMCT diet n = 9. At each time point, means without a common letter differ, P<0.05.

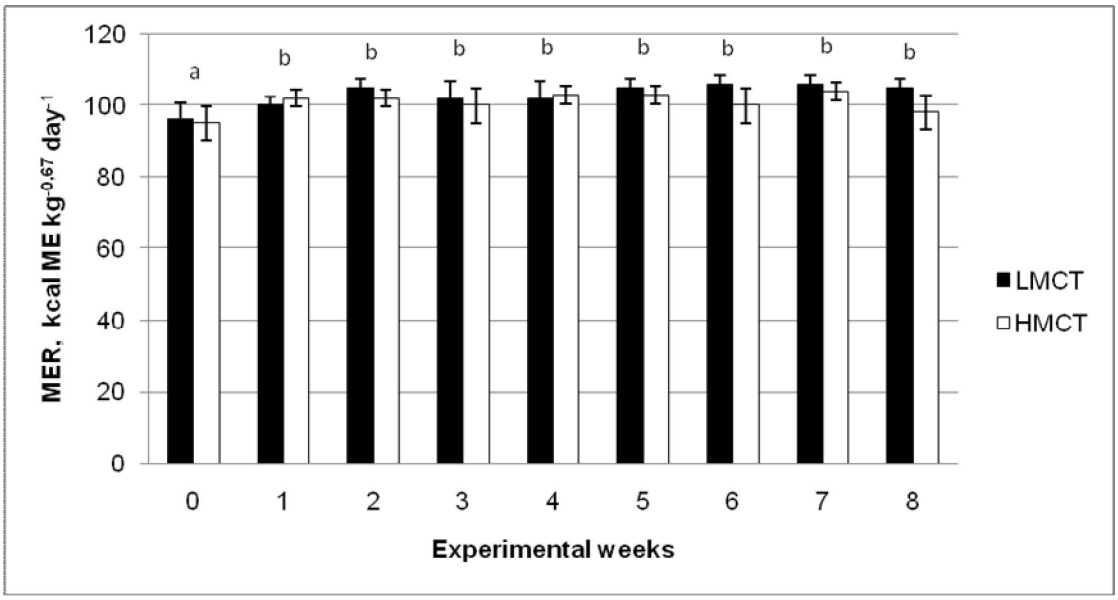

FIGURE 2: Maintenance Energy Requirement (MER), kcal ME $kg^{-0,67}$ day^{-1}, during the 8 week feeding period. Values are mean ± SEM, LMCT diet *n* = 10 and HMCT diet *n* = 9. At each time, means without a common letter differ, P<0.05.

CAPÍTULO III[4]

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Dietary γ-Linolenic Acid Supports Arachidonic Acid Enrichment in Feline Plasma Phospholipids and Feline Red Blood Cell Membranes [1]

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[6] Abbreviations used: LA, linoleic acid; AA, arachidonic acid; GLA, γ-linolenic acid; BCS, body conditions score; BW, body weight; TG, plasma triglycerides; TC, total cholesterol; LP, lipoprotein fractions; DGLA, dihomo-γ-linolenic acid.

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Abstract

Conversion of linoleic acid (LA) to arachidonic acid (AA) in cats is limited due to low Δ6-desaturase. Thus, it may be possible to induce Δ6 desaturase directly by providing large dietary amounts of LA precursor. In addition, an alternative pathway for AA may also exist involving LA chain elongation, followed by Δ8- and Δ5-desaturation. However, should an active Δ5-desaturase exist in feline tissues, it is more likely that dietary γ-linolenic acid (GLA) may bypass Δ6-desaturation and result in AA synthesis. Consequently, we hypothesized that GLA feeding bypasses Δ6-desaturation for AA synthesis. We further hypothesized that cats fed high LA results in AA accumulation either directly, by inducing Δ6-desaturase, or perhaps by the alternate route. To test these hypotheses, fatty acid profiles were determined after feeding high LA (HL), high GLA (GLA), or adequate LA (LL, control) diets. Adult female cats (n=29) were separated into three groups and fed for 8 wks according to their metabolic body weights to maintain body condition scores (BCS) of 5/9 with water *ad libitum*. Daily food consumption and weekly body weights (BW), maintenance energy requirements (MER) and BCS were recorded. Blood samples were collected after withholding food overnight at wks 0, 2, 4 and 8 to measure plasma triglyceride (TG) and total cholesterol (TC) concentrations as well as lipoprotein distributions (LP) and plasma and red blood cell phospholipid fatty acids. Repeated measures analysis of variance and Tukey (α=0.05) multiple comparisons were performed. No significant time effects were observed on food consumption, BW, BCS, and MER after Wk 1. No diet effects were observed for TG, TC, and lipoprotein fractions. However, time effects were observed at Wk2 and Wk4 with significant increases in these parameters but all were within normal limits and most likely due to the increased dietary fat content of the test diets. No evidence of Δ8-desaturase enzyme activity was found with the HL diet. However, a GLA diet effect was observed as early as wk2 with the formation of dihomo-γ-linolenic acid (DGLA ($20:3^{\Delta 8,11,14}$)) and AA as early as wk2, suggesting the presence of Δ5-desaturase activity. It is thus possible to use dietary GLA to induce AA synthesis.

Introduction

In most mammalian species the conversion of linoleic acid (LA) to arachidonic acid (AA) involves specific enzyme steps including Δ6 desaturation followed by chain elongation and Δ5 desaturation (1). By contrast, evidence that cats lacked sufficient Δ6 desaturase activity suggested that a dietary source of AA was necessary in this species, (2-5). Further speculation at that time about the existence of a feline Δ6 desaturase developed when cats were fed essential fatty acid (EFA) deficient diet using hydrogenated beef fat (6). In this case the accumulation of 20:3n-9 was found even though earlier studies did not detect this fatty acid (4-5). Because 20:3n-9 is produced by chain elongation and Δ6 desaturation of 18:1n-9 (7), it was hypothesized that Δ6-desaturase should be present in cats (8) (**Figure 1**).

In addition to this speculation, other authors suggested an alternative pathway for 20:3n9, synthesis in tissues independent of Δ6 desaturase. It is known that a Δ8-desaturase occur in rat testis is responsible for conversion of LA to AA (9). The Δ8-desaturase was also, described in human bladder and colon, (10). Thus, it may be possible that such a pathway might exist in feline species (1) (**Figure 1**).

When [1-^{14}C]-LA was included in the diet, no evidence was found for AA production. However, when [2-^{14}C] 20:3n-6 was given, there was significant production of AA, suggesting that cats do possess Δ5-desaturase activity (1).

Cats fed diets adequate in LA but deprived of other essential fatty acids (EFA), showed dry, lusterless hair coats, dandruff, behavioral infertility, and hepatic lipid infiltration (2). A series of studies (3-4; 12-13) ultimately demonstrated EFA deficiency, even though cats had been fed the requisite LA and ALA (14). Thus, came out the probability of other FA to be involved besides C18 precursors. When

γ-linolenic acid (GLA - 18:3n-6) containing oils were added to the diets, reproductive status improved (12). The GLA may have improved AA status to some extent by virtue of bypassing the Δ6 desaturase step. These studies have provided the basis for the present day concept that cats require a preformed source of AA and that Δ6 desaturase activity is either low or non-existent in feline species. However, the possibility remains that sufficient AA acid may be synthesized from LA under some condition using Δ5 and Δ8desaturases (6). In view of these possibilities, we hypothesized, that feeding cats dietary oil enriched in GLA could be a practical way to provide precursors for AA synthesis and that high dietary amounts of LA would induce an alternative AA synthetic pathway using Δ5 and Δ8desaturase enzymes.

Material and Methods

Animals and diets. Twenty nine adult, sexually intact female cats ranging in age between 1.5 to 2 years with body weights between 2.4 and 6.0 kg were used. Cats were individually maintained in kennels according to the American Physiological Society Guidelines for Animal Research, and the protocols were approved by Texas A & M University Animal Care and Use Committee. The cats were assessed to be clinically normal. The cats were assessed to be clinically normal prior to entering the study as indicated by complete blood counts, serum biochemistry profiles, and physical examination by one of the authors all of which were within normal limits. The animals were then randomly assigned into three groups according diet fed: High Linoleic Acid (HL, n=9), formulated with LA-rich safflower oil; Low Linoleic Acid (LL, n=10), in which safflower oil was replaced by coconut oil reduce LA to adequate levels, and γ-Linolenic Acid (GLA, n=10), formulated to contain adequate LA plus added borage oil with 70% GLA. The diets were similar in all respects except for FA type (**Table 1**). The expected nutrient composition of the diet was: 35% protein, 18% fat, 7,5% ash, 8% moisture, 2% crude fiber. After manufacture, analyses of the diets were performed analysis by Nestlé Purina Laboratories and results were within expected analytical variance for these targets (**Table 2**).

Cats were fed according to their individual metabolic weights (0,418 MJ ME * $Wkg^{-0,67}$ day^{-1}) and to maintain a body condition score (BCS) 5 out of 9 (18). The cats consumed a pre-experimental diet (PED) for 4 weeks prior to the start of the trial and were fed the experimental diets for 8 weeks. The nutrient composition of PED was: 30% protein, 10% fat, 12% moisture, 4,5% crude fiber and AA represented 0,02% of total diet. During the PED feeding period, daily food consumption was determined and used to maintain the animal's body weight at a

BCS 5. They were allowed to play with paper bags to provide physical activity. The controlled diet amounts fed and the stimuli to play helped them control their body weights. According to weekly weight evaluations the cats with BCS higher than 5 had were provided a reduced calorie allowance to $0.334*Wkg^{0,67}$ day^{-1}, because these cats were resistant to weight loss. Cats were maintained in this fashion until reaching the desired BCS 5. The experimental diets were formulated to be complete and balanced in order to meet or exceed minimal nutrient requirements established for adult cats (15-16) and manufactured by Nestlé Purina PetCare, Saint Louis.

Cat body weights (BW) and BCS were determined weekly during the PED period. The animals were fed once daily and food consumption and BMR (Body Maintenance Energy Requirement – MJ ME $kg^{0,67}$ day^{-1}) were recorded daily after 24 hours and averaged weekly for statistical analysis.

Blood sample collection and analyses. Blood samples were obtained from each cat by venipuncture at weeks 0, 2, 4 and 8 during the experimental periods. Food had been withheld for 12 hours and 7 ml of blood were drawn from a saphenous vein into EDTA-containing tubes. At week 0, complete blood counts and plasma biochemistry profiles were evaluated. Blood samples were centrifuged at 2800 rpm for 15 minutes and plasma was separated from the red blood cells (RBC) and plasma was frozen at -80^{o}C in small aliquots. Packed RBC's were kept on ice for immediate RBC membrane ghost preparation. RBC membranes were prepared using an isotonic saline wash, lysis with deionized water, followed by slow speed centrifugation and storage at -80^{o}C (17). Total lipids were then extracted from the both the plasma and RBC membranes (18). Total phospholipids fractions were separated by thin layer chromatography (TLC) scraped from the plates and

methylated to their fatty acid methyl esters (FAMEs) for analysis via gas chromatography (19).

Plasma triglycerides (TG) and total cholesterol (TC) concentrations were determined using enzymatic methods (20). Lipoprotein cholesterol distributions (LP-C) were determined using freshly isolated plasma by eletrophoresis (agarose gel at 1%) and quantified by scanning densitometry (20).

Digestibility assays. All cats were submitted to a digestibility study during week 6of the feeding period. Fecal samples were individually collected twice a day from for 5 consecutive days, pooled for each cat and frozen at -40 C. All samples, including the pooled samples and diets, were sent to the Nestlé Purina Petcare Laboratory, Saint Louis, for analysis. The parameters evaluated were coefficient of digestibility from crude protein, total fat, crude fiber, ash and gross energy. The coefficient for digestible energy (DE) was calculated and the metabolizable energy was calculated based on DE and urinary loss (15).

Statistical methods. Values presented are means $\pm$ SEM. All data except for the normative BCS data were found to be normally distributed by the Shapiro-Wilks. The BCS were thus analyzed by the nonparametric test Kruskal-Wallis one-way ANOVA (SAS 9). Digestibility coefficients were analyzed for main diet and time effects, and diet x time interactions using Proc GLM ANOVA by SAS ($P<0.05$). For the other data, statistical significance was determined using repeated measures ANOVA for diet, time, and diet x time interactions for the following plasma parameters (TG, TC, LP-C, plasma phospholipid fatty acid profile), RBC membrane fatty acid profile, food consumption, body weight, and metabolic factor using Proc

Mixed by SAS ($P < 0.05$). For all parameters Tukey's multiple comparison of means was performed where appropriate.

Results

Energy Consumption. All cats readily consumed the diets at the time they were offered and all food was consumed within 4 hours. No diet refusals were observed. Diet effects were not observed during the study for either the average weekly energy consumption or amounts of food (g) consumed (P=0.7677). A significant time effect for average weekly energy consumption was seen between week 0 and week 5 (**Table 3**). It should be noted that that although the energy densities of the experimental diets were similar, the PED contained less energy per kg (3200 kcal kg^{-1} calculated). Thus, the amount of PED food consumed was higher at week 0 when compared to week 8 (P=0.005).

FIGURA 1

Body weight and Body Condition Scores. The cats showed a slight weight loss from week 0 to week 8 (time effect P<0.001), but no diet effect was observed (P=0.8771) (**Table 3**). In spite of this modest weight loss, no change is BCS was seen. Some of the cats began the study with a BCS higher than 5/9. However, these animals readily achieved the desired BCS and no apparent diet (P=0.1068) or time (P=0.6679) effects were seen. Also no differences were observed among the diets for the animals' MER (P<0.1386) which remained stable except for some minor variation when comparing week 0 to the other time periods (P<0.0003) (**Table 3**).

FIGURA 2

Plasma Parameters (TG, TC, Lipoprotein fractions). Time effects but not diet effects were seen for all plasma lipids. All lipid values statistically significantly were increased at week 4 but remained within normal range for cats. Plasma TC was maximally elevated at week 4 as was the *α-LP-C* fraction. This fraction was

responsible for most of the total plasma cholesterol elevation although the other LP fractions also contributed to a lesser extent to this increase over time (**Table 3**). The *Pre-β-LP-C* followed a similar pattern with a maximal value achieved at week 2 remaining at week 4 and decreasing thereafter to its initial level at week 8. The *β-LP-C* also increased yet elevated at week 8 unlike the other LP-C fractions. No diet effect was observed for plasma TG (P=0.2452), but concentrations were significantly different over time (P=0.0372) (**Table 4**). Feeding the experimental diets resulted in statistically significant higher TG concentrations over baseline values at week 4 which decreased to baseline at week 8 but these elevations were small magnitude.

Plasma Phospholipid FA Profile (PLFA). Numerous time effects were observed reflecting the fatty acid content of the dietary experimental diets from baseline (**Table 5**). However, where diet* time interactions occurred additional ANOVA were performed to identify reasons for the differences (**Table 6**). Compared to the HL diet, both GLA and LL diets resulted in a statistically significant accumulation of 14:0 at wks 2 and 4 and this increase was maintained at wk 8 in the LL diet. Increases in 16:1 n7 were seen with time in all diets but LL was higher than GLA and HL at all sample times. Increased accumulation of 18:2n-6 was found with the HL and LL diets at week 2 and remained elevated throughout the study compared to the GLA diet which showed no change in plasma PL 18:2n-6 relative amounts.

However, the GLA diet dramatically affected 18:3n-6 concentrations. At wk 2, this fatty acid was about 4 times higher than wk 0 and slowly decreased but remained approximately 3 times higher than wk 0. These values were statistically different compared to the HL and LL diets. Furthermore, amounts 20:3n-6 (Δ8,11,14) were significantly increased with the GLA diet. The concentration in plasma PL increased

more than 5 times at wk2 and continued to increase to nearly 7 times the basal values at wk 8. It is noteworthy that after week 2, relative amounts of 18:3n-6 decreased at the same time as 20:3 n6 increased.

Differences in 20:4n-6 contents were also observed even though all dietary concentrations were identical. Both the HL and LL diets resulted in decreased plasma PL 20:4n-6 at all sample times compared with baseline values. However, when the GLA diet was fed, the 20:4n-6 content remained constant such that a statistically significant difference was seen between the GLA and HL diets, while the LL diet showed intermediate values. It is especially noteworthy that the HL diet showed a statistically significant increases in both 20:2 n6 and 20:3n-6 (Δ5,11,14) compared to the GLA diet at all sample times.

Red Blood Cells Membranes Phospholipids Profile. As with the plasma PLFA profiles, RBC membranes FAs showed the similar findings. Diet and time effects are shown in the table (**Table 7**). The interactions between diet and time are similar to plasma PLFAs (**Table 8**). Small amounts of 12:0 were found especially in cats fed diets containing higher amounts medium chain fatty acids.

The amount of 18:2 n6 increased in HL diet reaching maximal values at wks 2 and 4 then returning to baseline thereafter. However, GLA and LL diets resulted in no changes in this fatty acid. The presence of γ-linolenic acid in the GLA diet promoted a marked accumulation of 18:3 n6 in the membranes readily at wk2 and thereafter. Marked increases of 20:3 n6 (8,11,14) were also seen with this diet. Furthermore the GLA resulted in the elevation of AA in the membranes after wk2 and thereafter and especially compared with the other two diets where decrements were observed. The HL resulted significant increase of 20:2 n6 in the RBC

membranes. Unlike the plasma PL-FA, however, no diet*time interactions were found for the 20:3 n6 (5,11,14), but numerically, HL and LL diet values were numerically higher.

Digestibility assay. For all parameters tested only total fat digestibilities were different among diets (P=0.0398). The HL (92.2%) was different than GLA (94.3%) and LL diets (93.2%).

Discussion

None of the diets had any differential effects on amounts consumed, BW, BMR and BCS. Comparative values at wk 0 were somewhat different from the other values because the first week of feeding was used for adaptation to the experimental diets which, for cats generally requires 4-5 days (16). Eliminating the wk 0 values from the analysis revealed neither time nor diet effects except for the decrease in body weight which was planned. In the other weeks some variation can be observed and at the end of this trial it is possible see reduced values for BW and consumption parameters. Cats were fed to maintain the BCS 5 out 9 and for that reason they reached such values at the end of this trial. Cats reduced slightly the BW being difficult to detect it by BCS evaluation. The BMR found for cats in maintenance was approximately the same indicated for this category (15).

Plasma lipids, as TG and TC and their fractions showed similar behavior without any diet effect, so γ-linolenic diet did not produce any isolated effect. Along of the weeks the increase and decrease in plasma parameters are directly associated to the content of crude fat present in the experimental diets more than in their qualities. Cats showed to be versatile in their metabolism, adapting easily to the new diets after wk 4. The elevation of lipids in the plasma is an expected effect since the diet they were eating had around 190 g kg^{-1} DM crude fat, while the PED had around 120 g kg^{-1} DM. In addition, the high digestibility of fat is other factor to the enrichment of fat in the plasma. Unlike in humans the cat reaction against a high fat diet seems like to be protective (21). The increase in lipoproteins fraction rises up the α-LP-C fraction (HDL) as a response to the over uptake of lipids from the diet, working as a protective metabolism against cardiac diseases (22-23).

The effects of the diets were seem more clearly when the fatty acids accumulation or in plasma PL (**Figure 2**) either in red blood cells PL (**Figure 3**) were evaluated. When fatty acids in the diets overpass the animal needs is common see the accumulation in the tissues. Usually, LCFA are more readily incorporated due to the Fatty Acid Synthetase enzyme which is more effective in esterify triglycerides with LCT (24). It was notorious the incorporation of 18:2 n6 in the membranes associated to HL diet, but it did not show any alteration in 18:3 n6 concentration in the plasma PL or in the RBC PL, demonstrating Δ6 desaturase absence or very low activity as already was known (2-5). However, the effect of elongase enzyme was expressed over the high concentration of 18:2 n6. In this case 20:2 n6 was increased continually in the plasma and RBC PL initiating the alternative pathway forward to AA synthesis. This route was viable until the next step which one depended on Δ5 desaturase to produce 20:3 n6 (Δ5,11,14) from 20:2 n6, and the concentration was really increased.

The knowledge that some species showed to present Δ8-desaturase (9-10) was not applicable to the cats in this trial, since the AA concentration decreased in the plasma and in the membranes in the time. The high concentration in the wk 0 probably was consequence of the diet that cats had been fed before PED. It was a diet for adult cats with higher concentration of AA, compounding around 0,07% of total diet. Probably that is the cause of AA plasma levels decreased in the time so fast.

The LL diet had the LA 3.5 times smaller than HL diet but, the effects over the normal pathway and the alternative pathway seems to be the same for most part of the fatty acids when compared to HL diet. However, the HL diet induced the elongase enzyme more efficiently that LL diet, probably through the concentration

resulting in a higher increase in 20:2n6. The concentration of AA in plasma PL and RBC PL did not changed between diets, but curiously the LL had higher numeric values when compared to HL diet. It probably happened in HL diet because of Δ5 desaturase was more demanded in the alternative pathway than in the normal pathway since 20:2 n6 was increased. By the values it is possible see in plasma and in RBC that the concentration of 20:3 n6 (8,11,14) is always higher in LL diet and that FA is a product of elogase enzyme and a substrate for Δ5 desaturase enzyme which ones are involved in the alternative pathway in HL diet by substrate induction. It reflects the AA concentration that followed the same way being numerically higher in LL, since alternative pathway is not functional probably due to Δ8-desaturase enzyme inexists.

The GLA diet bypassed the Δ6 enzyme efficiently. The incorporation in the membranes was faster end efficient. The γ-linolenic acid in plasma PL was decreasing after wk2 showing an effect of elongase enzyme induction. It can be better noticed when DGLA is observed, its concentration is progressively increased in the time, which supports AA concentration. The same happened in the RBC, as prove of that in the tissues AA can be maintained by supplementing γ-linolenic acid in the diet. Interestingly, if observed the concentration of γ-linolenic acid in the plasma PL or RBC it is not more than 0,9% at anytime, but the concentration of its product (DGLA) is increasing continuously and that values are always higher than 2,5% showing the high and progressive increase in elongase enzyme activity as described previously (25). It is the guaranty that providing GLA, DGLA will be formed in cats. The DGLA belongs to a group of FA proved to have anti-inflamatory effects and immunomodulating properties on the skin. It modulates the eicosanoid production by competing with AA for ciclo-oxigenase and lipo-

oxigenase in the AA cascade. This competition results in a shift towards production of LT with anti-inflamatory properties (prostaglandins and tromboxanos, serie 1 and leukotrienes serie 3) instead of proinflammatory LT (LTB4 and PG2). Atopic dermatitis is marked by pruritus and had been treated by association between GLA and EPA as anti-inflammatory FA. Some authors still have doubts about this type of treatment due to high variation and difficult way to evaluate the animals based in their symptoms. A study in dogs concluded that early stages cases seem to be more responsive to the anti-inflamatory FA supplementation (26). Other study in guinea pig induced epidermal hyperproliferation was reverted adding different sources of GLA containing oils (27). The supplementation of DGLA in NC/Nga atopic mice resulted in incorporation in the PL and reduction of symptoms which ones were induced again through discontinuation of supplementation (28).

Several sources of γ-linolenic acid are available as a borage oil, evening primrose oil, canola oil genetically modified (29), *Spirulina platensis* (30) and it is possible find DGLA oil extract from the fungus *Mortierella alpine* which one contain approximately 40% DGLA (31). According to this can be possible include in the diets its components.

In summary, diets containing GLA can be consumed by cats normally with no alteration in BW if the requirements are attended. Cats showed do not have Δ6 and Δ8 desaturase active. The elongase enzyme is highly active and its activity is induced by substrate as was demonstrated in HL diet, 18:2 n6 to 20:2 n6, and GLA diet (18:3 n6 to 20:3 n6). In the same way Δ5 desaturase showed to be active in cats. In HL diet it promoted the desaturation in 20:2 n6 to 20:3 n6 (Δ5,11,14) and in the GLA diet promoted the desaturation over DGLA to form AA. Additionally, GLA diet promoted the accumulation of γ-linolenic acid and dihomo-γ-linoleic acid in the

plasma and tissues which ones can be effective anti-inflammatory eicosanoids and prostaglandins being a key point to modulate the immunological system. In the same time GLA diet supported AA concentration in the membranes in cats fed minimal requirements of AA.

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TABLE 1

Experimental diet fatty acids profile[1]

Fatty acids	Diet		
	GLA[2]	HL[3]	LL[4]
	g/kg dry matter		
06:0	0,4	<0,1	0,4
08:0	5,7	2,3	6,0
10:0	4,9	2,3	5,0
12:0	41,2	16,5	43,4
14:0	17,5	7,6	18,4
16:0	29,7	28,9	29,7
16:1(n-7)	4,5	4,5	4,4
18:0	9,3	9,2	9,2
18:1(n-9)	36,8	45,9	36,6
18:1(n-7)	1,8	2,3	1,8
18:2(n-6)	21,8	71,0	20,8
18:3(n-6)	4,2	0,2	<0,1
18:3(n-3)	1,5	2,1	1,4
20:4(n-6)	0,3	0,3	0,3
Saturated	109	68	113
Monounsaturated	45	55	45
Poliunsaturated	28	74	23

[1]Values are the means of duplicate determinations
[2]Borrage oil (γ-linolenic acid 70%) plus coconut oil
[3]Safflower oil
[4]Coconut oil

TABLE 2

Experimental diet nutrient profile[1]

	Diet		
Nutrient	GLA[2]	HL[3]	LL[4]
	g/kg dry matter		
Crude Protein	346	355	349
Nitrogen-free extract	378	351	378
Fiber	21	18	20
Ash	71	77	70
Fat	185	199	182
Energy, *ME kcal/kg*[5]	4417	4316	4327

[1]The diets are designated on the basis of their contents. The dry, extruded-type diets were manufactured by Nestlé-Purina Petcare. Diet ingredients (by weight): Brewers milled rice, 35.9%; Soybean protein isolated, 23.3%; Chicken whole carcass and parts, 21.6%; Soybean hulls, 3.67%; Dicalcium phosphate, 2.93%; Coconut oil, 2.80%; Flavor coating, 1.5%; Beef tallow, 0,7%; Potassium chloride, 0.65%; Mineral premix, 0.34%; Choline chloride, 0.32%; Calcium carbonate, 0.29%; Sodium chloride, 0.22%; DL-methionine, 0.18%; Taurine, 0.1%; Vitamin premix, 0.07%; Vitamin E (50%), 0.03%. Vitamin premix contents: 146.32 g/kg nicotinicacid, 10.35 g/kg vitamin A acetate, 90 g/kg dl-α-tocopherol acetate, 84 mg/kg cholecalciferol, 52 g/kg thiamine mononitrate, 51.06 g/kg calcium D-pantothenate, 24.4 g/kg riboflavin, 14.52 g/kg pyridoxine hydrochloride, 6 g/kg folic acid, 508 mg/kg menadione sodium bisulfite, 93 mg/kg vitamin B-12, and 36.8 mg/kg biotin. Mineral mix contents: 65 g/kg zinc as zinc sulfate, 39 g/kg iron as ferrous sulfate, 18.25 g/kg manganese as manganese sulfate, 3.2 g/kg copper as copper sulfate, 651 mg/kg iodine as calcium iodate, and 50 mg/kg selenium as selenium selenite. The remaining percent of each diet were consisted of three dietary oils: Coconut oil, 5.58% in LL diet and Safflower oil, 5.24% in HL diet, which provided the desired fatty acid profiles, Coconut oil 4,85% and Borrage oil at 70% GLA, 0,5%. Values are the means of duplicate determinations

[2]Borrage oil (γ-linoleic acid 70%) plus coconut oil

[3]Safflower oil

[4]Coconut oil

[5]Value obtained according to digestibility

TABLE 3

Food Consumption, Body weight and Body Maintenance Requirements recovered daily and weekly averaged - 9 weeks[1]

Source	Diet				Time (Week)									
	GLA	HL	LL	*P* Value	0	1	2	3	4	5	6	7	8	*P* Value
BW (kg)[2]	3,48±0,3	3,42±0,3	3,59±0,2	0,8771	3,52±0,24^{ab}	3,57±0,24^{a}	3,50±0,24^{ab}	3,50±0,24^{ab}	3,49±0,24^{ab}	3,49±0,23^{ab}	3,48±0,23^{ab}	3,49±0,22^{ab}	3,46±0,22^{b}	0,0001
Cons (kcal)[3]	1726±70	1653±92	1662±83	0,7677	1598±102^{b}	1678±84^{ab}	1691±77^{ab}	1693±88^{ab}	1693±79^{ab}	1713±76^{a}	1698±81^{ab}	1703±71^{ab}	1659±78^{ab}	0,0335
Cons (g)[4]	61±2,5	60±3,3	61±2,0	0,9861	63±3,1^{a}	60±2,7^{ab}	60±2,4^{ab}	60±2,7^{ab}	60±2,5^{ab}	61±2,4^{ab}	61±2,5^{ab}	61±2,3^{ab}	59±2,4^{b}	0,0050
MER[5]	108±2,4	103±3,2	101±3,1	0,1386	97±3,7^{b}	103±2,1^{ab}	105±2,4^{a}	105±3,7^{a}	105±2,9^{a}	106±2,6^{a}	106±3,1^{a}	106±2,4^{a}	104±3,3^{ab}	0,0003

[1] Values are means ± SEM, GLA (diet n = 9) HL diet (n = 10) and LL diet (n = 9). Means in the row with superscripts without common letters differ $P<0.05$. No significant difference was found for Diet *vs* Time. [2]Body Weight (kg); [3]Consumption (kcal week^{-1}); [4]Consumption (g day^{-1}); [5] Maintenance Energy Requirement (kcal kg$^{-0,67}$).

TABLE 4

Plasma lipid and lipoprotein-cholesterol concentrations in adult cats fed experimental diets during 9 weeks[1]

Source	Diet				Time (week)					Diet *vs* Time
	GLA	HL	LL	*P* Value	0	2	4	8	*P* Value	*P* Value
	mg/dL				*mg/dL*					
β-LP-C	21±1,3	24±1,7	22±1,4	0,6860	14±2,0[a]	24±1,3[b]	27±2,2[b]	25±1,7[b]	0,0001	0,8445
Pre-*β*-LP-C	29±2,1	27±1,8	31±1,8	0,5001	25±2,8[a]	36±1,9[b]	32±3,0[b]	24±2,4[a]	0,0001	0,4161
α-LP-C	108±5,8	107±4,9	108±6,6	0,9740	81±4,9[a]	91±4,8[a]	138±7,8[b]	122±8,3[c]	0,0001	0,5349
Total Cholesterol	158±7,7	157±6,5	162±8,1	0,9586	119±7,7[a]	151±7,3[b]	196±9,8[c]	170±10[d]	0,0001	0,4002
Triglycerides	25±1,3	21±0,8	24±1,2	0,2452	24±1,6[ab]	24±1,8[ab]	25±1,7[a]	21±1,5[b]	0,0372	0,7182

[1] Values are means ± SEM, GLA diet (*n* = 9), HL diet (*n* = 10) and LL diet (*n* = 9). Means in the row with superscripts without common letters differ, $P < 0.05$.

TABLE 5

Cats Plasma Phospholipids Fatty Acids Profile (Relative %)[1]

	Diet					Time						Diet *vs* Time
Fatty Acids	GLA	HL	LL	St Error	*P* Value	Week 0	Week 2	Week 4	Week 8	St Error	*P* Value	*P* Value
12:0	0,03	TR	0,02	TR	NS	0,01	0,01	TR	0,04	0,001	NS	NS
14:0	0,44	0,29	0,49	0,03	0,0004	0,19	0,54	0,5	0,41	0,03	0,0001	0,0017
15:0	0,11	0,1	0,09	0,01	0,6527	$0,11^{a}$	$0,12^{a}$	$0,10^{ab}$	$0,06^{b}$	0,01	0,0076	0,2536
16:0	14,1	13,7	14,5	0,03	0,2810	$13,5^{bc}$	$15,2^{a}$	$14,7^{ab}$	$13,1^{c}$	0,29	0,0001	0,4854
16:1 n7	0,5	0,43	0,65	0,03	0,0004	0,39	0,63	0,58	0,5	0,24	0,0001	0,0117
17:0	0,46	0,42	0,43	0,02	0,5204	$0,70^{a}$	$0,37^{b}$	$0,37^{b}$	$0,30^{b}$	0,03	0,0001	0,5872
17:1 n	0,04	0,04	0,04	0,01	0,9915	0,05	0,05	0,04	0,01	0,02	0,1334	0,8738
18:0	28,7	27,9	27,4	0,46	0,1670	$28,9^{a}$	$27,6^{a}$	$28,0^{ab}$	$27,5^{b}$	0,34	0,0013	0,2012
18:1 n9	$9,23^{b}$	$8,67^{c}$	$10,04^{a}$	0,17	0,0001	$10,9^{a}$	$8,8^{b}$	$8,8^{b}$	$8,8^{b}$	0,15	0,0001	0,0850
18:1 n7	2,07	2,19	2,31	0,12	0,3828	2,40	2,30	2,10	1,95	0,08	0,0001	0,0086
18:2 n6	22,0	31,0	28,2	0,50	0,0001	25,1	28,1	26,9	28,3	0,48	0,0001	0,0001
18:3 n6	0,58	0,06	0,11	0,03	0,0001	0,23	0,33	0,24	0,21	0,03	0,0005	0,0001
18:3 n3	0,28	0,26	0,32	0,02	0,2578	$0,24^{b}$	$0,29^{ab}$	$0,33^{a}$	$0,28^{ab}$	0,02	0,0133	0,3396
20:0	$0,84^{b}$	$0,98^{a}$	$0,78^{b}$	0,05	0,0250	$0,91^{ab}$	$0,81^{b}$	$0,81^{b}$	$0,94^{a}$	0,04	0,0019	0,2671
20:1 n9	0,37	0,43	0,37	0,02	0,0831	0,42	0,38	0,38	0,39	0,03	0,6549	0,1475
20:2 n6	0,58	0,95	0,71	0,05	0,0001	0,66	0,68	0,76	0,89	0,03	0,0001	0,0001
20:3 n6 (5,11,14)	0,57	0,72	0,77	0,04	0,0013	0,69	0,66	0,67	0,73	0,03	0,0351	0,0052
20:3 n6 (8,11,14)	6,78	0,98	1,48	0,20	0,0001	1,15	3,26	3,71	4,21	0,24	0,0001	0,0001
20:4 n6	6,29	4,88	5,68	0,27	0,0028	6,75	5,06	5,25	5,39	0,19	0,0001	0,0078
20:5 n3	$0,22^{ab}$	$0,12^{b}$	$0,24^{a}$	0,03	0,0177	$0,39^{a}$	$0,17^{b}$	$0,16^{b}$	$0,05^{c}$	0,04	0,0001	0,3154
22:0	0,59	0,64	0,55	0,01	0,1485	$0,64^{a}$	$0,45^{b}$	$0,61^{a}$	$0,66^{a}$	0,04	0,0005	0,9211

Continuing… TABLE 5

Cats Plasma Phospholipids Fatty Acids Profile (Relative %)[1]

	Diet					Time						Diet *vs* Time
Fatty Acids	GLA	HL	LL	St Error	*P* Value	Week 0	Week 2	Week 4	Week 8	St Error	*P* Value	*P* Value
22:4 n6 22:5 n3	1,06	0,96	1,02	0,06	0,4580	1,16^{a}	0,68^{b}	1,06^{a}	1,16^{a}	0,07	0,0001	0,5909
22:6 n3 24:0	1,75	1,64	1,58	0,09	0,3897	2,17^{a}	1,31^{b}	1,56^{b}	1,59^{b}	0,09	0,0001	0,6110
24:1 n9	1,00^{b}	1,23^{a}	0,98^{b}	0,06	0,0106	1,16^{a}	0,81^{b}	1,10^{a}	1,22^{a}	0,08	0,0001	0,4782
Sat	45,9	44,8	44,9	0,50	0,2140	45,9^{a}	45,7^{a}	45,4^{ab}	43,9^{b}	0,47	0,0014	0,4837
MUFAS	13,3^{b}	13,0^{b}	14,4^{a}	0,28	0,0052	15,4^{a}	13,0^{b}	13,0^{b}	12,8^{b}	0,23	0,0001	0,2583
PUFAS	39,4	40,8	39,5	0,52	0,1306	37,6^{c}	39,8^{b}	40,4^{ab}	41,9^{a}	0,52	0,0001	0,6370
HUFAS	8,64	6,84	7,88	0,33	0,0026	9,55	6,56	7,78	7,26	0,27	0,0001	0,0314
UI	1,31	1,3	1,15	0,16	0,7227	1,02	1,4	1,19	1,42	0,18	0,2198	0,2180

[1] Values are means, GLA diet (*n* = 10), HL diet (*n* = 9) and LL diet (*n* = 9); Superscript letters not in common indicate a significant difference between diets and time ANOVA, P < 0.05; NI=non statistical; SAT =sum of all saturated FA; MUFAS=sum of all FA with one double bond; PUFAS=sum of all FA with more than 2 double bonds; HUFAS=sum of all FA with more than 4 double bonds; UI = No identified FA.

TABLE 6

Cats Plasma Phospholipids Fatty Acids Profile (Relative %)[1]

	GLA (n=10)				HL (n=9)				LL (n=9)			
Fatty Acids	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8
12:0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
14:0	0.27±0.06^{a1}	0.60±0.08^{b12}	0.52±0.04^{b12}	0.39±0.05^{a1}	0.16±0.03^{a1}	0.36±0.03^{a2}	0.31±0.03^{a2}	0.32±0.05^{a1}	0.15±0.02^{a1}	0.65±0.05^{b1}	0.67±0.06^{b1}	0.51±0.04^{b1}
15:0	0.15±0.02	0.13±0.03	0.08±0.02	0.05±0.03	0.09±0.03	0.12±0.02	0.12±0.03	0.07±0.02	0.10±0.02	0.10±0.02	0.11±0.03	0.06±0.02
16:0	14.3±0.91	14.9±0.71	14.7±0.40	12.6±0.59	13.0±0.57	14.8±0.37	14.4±0.42	12.7±0.84	13.3±0.42	15.8±0.50	15.0±0.50	13.9±0.49
16:1 n7	0.39±0.03^{a1}	0.62±0.04^{b12}	0.53±0.03^{a12}	0.46±0.04^{a12}	0.35±0.04^{a1}	0.49±0.03^{b1}	0.44±0.03^{b1}	0.44±0.05^{b1}	0.43±0.03^{a1}	0.78±0.07^{b2}	0.76±0.08^{b2}	0.61±0.04^{b2}
17:0	0.72±0.02	0.47±0.10	0.38±0.02	0.26±0.04	0.70±0.08	0.30±0.06	0.37±0.04	0.30±0.05	0.68±0.01	0.33±0.04	0.36±0.01	0.32±0.04
17:1 n	0.05±0.04	0.06±0.02	0.04±0.03	TR	0.06±0.03	0.03±0.02	0.04±0.03	0.03±0.03	0.05±0.03	0.06±0.02	0.04±0.04	TR
18:0	29.0±0.66	28.0±0.60	29.3±0.59	28.4±0.52	29.2±0.66	27.7±0.73	27.9±0.93	26.8±0.49	28.5±0.85	27.2±0.95	26.9±0.50	27.2±0.49
18:1 n9	10.8±0.38	8.76±0.17	8.83±0.22	8.52±0.28	10.7±0.59	8.03±0.19	7.68±0.19	8.52±0.22	11.2±0.31	9.58±0.49	8.86±0.23	9.54±0.33
18:1 n7	2.34±0.19^{a}	2.14±0.17^{ab}	2.02±0.12^{ab}	1.80±0.12^{b}	2.19±0.18^{a}	2.21±0.12^{a}	2.27±0.18^{a}	2.10±0.18^{a}	2.58±0.15^{a}	2.55±0.38^{ab}	2.15±0.14^{ab}	1.94±0.08^{b}
18:2 n6	23.8±1.02^{a1}	22.8±0.6^{a1}	20.5±0.65^{a1}	21.0±0.49^{a1}	26.0±0.70^{a1}	32.2±0.52^{b2}	31.9±1.70^{b2}	34.0±0.71^{b2}	25.6±0.64^{a1}	29.2±1.23	28.3±0.96^{ab2}	29.9±1.11^{b3}
18:3 n6	0.26±0.06^{a1}	0.82±0.08^{b1}	0.67±0.06^{bc1}	0.58±0.04^{c1}	0.21±0.06^{a1}	<0.1 ^{a2}	<0.1 ^{a2}	0.02±0.02^{a2}	0.20±0.07^{a1}	0.17±0.04	0.04±0.04^{a2}	0.03±0.03^{a2}
18:3 n3	0.23±0.05	0.29±0.04	0.30±0.01	0.30±0.04	0.26±0.04	0.23±0.04	0.28±0.02	0.24±0.02	0.24±0.07	0.32±0.06	0.41±0.02	0.29±0.06
20:0	0.96±0.08	0.74±0.04	0.75±0.04	0.90±0.04	0.87±0.08	0.96±0.08	1.00±0.11	1.07±0.07	0.88±0.06	0.72±0.10	0.68±0.06	0.84±0.02
20:1 n9	0.41±0.02	0.42±0.07	0.32±0.05	0.33±0.04	0.40±0.04	0.39±0.04	0.45±0.03	0.49±0.05	0.44±0.05	0.32±0.02	0.38±0.05	0.35±0.03
20:2 n6	0.66±0.05^{a1}	0.52±0.03^{a1}	0.55±0.04^{a1}	0.60±0.04^{a1}	0.66±0.08^{a1}	0.89±0.12^{b2}	1.02±0.09^{b2}	1.24±0.11^{c1}	0.65±0.04^{a1}	0.64±0.03^{a12}	0.72±0.03^{a1}	0.83±0.05^{a12}
20:3 n6 (5)[2]	0.61±0.04^{a1}	0.57±0.03^{a1}	0.52±0.03^{a1}	0.56±0.03^{a1}	0.73±0.08^{ab1}	0.67±0.08^{ab1}	0.66±0.06^{b12}	0.80±0.05^{a2}	0.72±0.03^{a1}	0.73±0.06^{a1}	0.82±0.04^{a2}	0.81±0.05^{a2}
20:3 n6 (8)[3]	1.43±0.13^{a1}	7.43±0.26^{b2}	8.45±0.48^{c2}	9.80±0.66^{d2}	0.97±0.05^{a1}	0.92±0.05^{a1}	0.99±0.13^{a1}	1.03±0.07^{a1}	1.04±0.04^{a1}	1.42±0.10^{a1}	1.68±0.06^{a1}	1.79±0.12^{a1}
20:4 n6	6.63±0.44^{a1}	5.79±0.31^{a1}	6.10±0.23^{a1}	6.65±0.33^{a1}	6.78±0.50^{a1}	4.34±0.21^{b1}	4.23±0.42^{b2}	4.14±0.37^{b2}	6.84±0.26^{a1}	5.06±0.43^{b1}	5.43±0.30^{ab12}	5.38±0.35^{ab12}
20:5 n3	0.37±0.04	0.31±0.11	0.14±0.06	0.06±0.02	0.35±0.04	0.04±0.02	0.08±0.04	0.02±0.00	0.45±0.03	0.16±0.04	0.27±0.07	0.09±0.03
22:0	0.68±0.06	0.40±0.06	0.60±0.04	0.66±0.10	0.67±0.04	0.52±0.04	0.67±0.04	0.70±0.09	0.57±0.08	0.44±0.03	0.56±0.06	0.62±0.04
22:4n6+22:5 n3	1.11±0.06	0.67±0.05	1.15±0.05	1.30±0.20	1.20±0.08	0.67±0.04	0.90±0.11	1.09±0.09	1.17±0.04	0.69±0.06	1.12±0.16	1.10±0.12

Continuing… TABLE 6

Cats Plasma Phospholipids Fatty Acids Profile (Relative %)[1]

	GLA (n=10)				HL (n=9)				LL (n=9)			
22:6 n3+24:0	2.06±0.18	1.43±0.12	1.81±0.25	1.72±0.25	2.23±0.15	1.28±0.08	1.50±0.16	1.56±0.18	2.21±0.13	1.23±0.11	1.38±0.08	1.50±0.15
24:1 n9	1.09±0.10	0.75±0.06	1.00±0.06	1.16±0.18	1.21±0.15	0.93±0.15	1.36±0.13	1.41±0.19	1.19±0.08	0.73±0.08	0.93±0.07	1.08±0.11
SAT	47.0±1.17	45.9±0.62	46.5±0.79	44.3±0.69	45.6±0.97	45.5±0.82	45.3±1.09	43.0±0.86	45.1±1.00	45.8±1.46	44.4±0.58	44.4±0.67
MUFAS	15.3±0.51	12.8±0.29	12.7±0.38	12.3±0.41	15.0±0.92	12.1±0.37	12.3±0.31	12.7±0.46	15.9±0.45	14.0±0.44	14.1±0.35	13.5±0.44
PUFAS	36.3±1.30	39.7±0.71	40.0±0.96	41.9±0.80	38.4±1.04	40.6±0.64	41.1±1.44	43.1±1.13	38.2±0.71	39.1±1.62	39.9±0.73	40.9±0.71
HUFAS	9.30±0.53^{a1}	7.49±0.30^{a1}	9.05±0.41^{a1}	8.73±0.61^{a1}	9.64±0.66^{a1}	5.63±0.24^{a1}	6.28±0.59^{b2}	5.82±0.52^{b2}	9.72±0.35^{b2}	6.56±0.57^{b12}	8.01±0.46^{ab12}	7.22±0.53^{ab12}
UI	1.29±0.28	1.38±0.31	0.73±0.43	1.86±0.20	0.96±0.29	1.76±0.32	1.30±0.45	1.20±0.21	0.81±0.29	1.06±0.33	1.54±0.45	1.19±0.21

[1] Values are means ± SEM, GLA diet (*n* = 10), HL diet (*n* = 9) and LL diet (*n* = 9); Superscript letters not in common in a row within a diet group indicate a significant difference between weeks by ANOVA, $p < 0.05$ and superscript numbers not in common in a row within a week indicate a significant difference between diets by ANOVA, $p < 0.05$; Fatty Acid 20:3 n6 (Δ5,11,14), Fatty acid 20:3 n6 (Δ8,11,14). TR = Trace (<0.01); SAT =sum of all saturated FA; MUFAS=sum of all FA with one double bond; PUFAS=sum of all FA with more than 2 double bonds; HUFAS=sum of all FA with more than 4 double bonds; UI = non identified FA.

TABLE 7

Red Blood Cells Phospholipids Fatty Acids Profile[1]

	Diet					Time						Diet *vs* Time
FA	GLA	HL	LL	SE	*P* Value	Week 0	Week 2	Week 4	Week 8	SE	*P* Value	*P* Value
12:0	0,07[a]	0,02[b]	0,07[a]	0,01	0,0081	0,01[b]	0,06[ab]	0,05[ab]	0,09[a]	0,01	0,0001	0,1223
14:0	0,55	0,36	0,67	0,04	0,0001	0,24	0,57	0,63	0,69	0,04	0,0001	0,0001
15:0	0,05	0,05	0,05	0,01	0,9810	0,13[a]	0,05[b]	0,01[c]	TR[c]	0,01	0,0001	0,6980
16:0	21.0	20,6	21,7	0,47	0,3355	20,0[b]	22,0[a]	22,0[a]	20,5[ab]	0,53	0,0081	0,6209
16:1 n7	0,32	0,31	0,34	0,03	0,1817	0,33	0,30	0,34	0,32	0,03	0,9082	0,1978
17:0	0,57	0,72	0,51	0,08	0,4018	0,68[b]	0,61[ab]	0,47[a]	0,64[ab]	0,08	0,0001	0,3540
18:0	16,2	15,2	16,3	0,33	0,9800	16,3[b]	14,9[c]	16,3[ab]	17,4[a]	0,33	0,0001	0,2068
18:1 n9	7,12	6,96	7,56	0,15	0,1371	7,80[a]	7,30[ab]	7,22[b]	6,54[c]	0,16	0,0001	0,2186
18:1 n7	2,86	2,88	3,20	0,19	0,3947	3,05	3,42	2,82	2,62	0,19	0,1610	0,1958
18:2 n6	18,7	24,5	20,2	0,54	0,0001	19,7	21,9	22,5	20,9	0,74	0,0002	0,0007
18:3 n6	0,4	0,08	0,03	0,04	0,0001	0,05	0,20	0,17	0,17	0,05	0,0004	0,0001
18:3 n3	0,21	0,16	0,21	0,03	0,1304	0,21	0,16	0,20	0,19	0,03	0,6053	0,4767
20:0	0,44	0,48	0,50	0,03	0,2699	0,56	0,57	0,44	0,33	0,03	0,0001	0,0033
20:1 n9	0,44	0,49	0,50	0,02	0,1500	0,56[a]	0,50[a]	0,49[a]	0,36[b]	0,02	0,0001	0,5244
20:2 n6	0,74	1,10	0,86	0,03	0,0001	0,92	0,89	0,96	0,83	0,05	0,0901	0,0025
20:3 n6 (5,11,14)	1,06[b]	1,38[a]	1,34[a]	0,06	0,0140	1,28[ab]	1,09[a]	1,36[b]	1,32[ab]	0,07	0,0145	0,2481
20:3 n6 (8,11,14)	3,03	0,73	0,92	0,1	0,0001	1,04	1,37	1,87	1,96	0,23	0,0001	0,0001
20:4 n6	11,8	9,49	10,2	0,33	0,0015	11,4	9,26	10,6	10,7	0,4	0,0001	0,0001
20:5 n3	0,19	0,18	0,29	0,04	0,1130	0,36[a]	0,14[b]	0,2[b]	0,16[b]	0,04	0,0001	0,5190
22:0	0,77	0,77	0,77	0,05	0,9988	0,90[a]	0,81[ab]	0,63[b]	0,74[ab]	0,05	0,0001	0,1121
22:1 n9	0,14	0,16	0,17	0,02	0,8256	0,23[a]	0,22[a]	0,08[b]	0,09[b]	0,02	0,0001	0,3668
22:4 n6	1,09[a]	0,80[b]	0,83[b]	0,06	0,0054	0,89	0,87	1,02	0,84	0,07	0,2898	0,2260
22:5 n3	0,08	0,10	0,07	0,02	0,4740	0,19[a]	0,12[a]	0,03[b]	TR[b]	0,02	0,0001	0,2364

Continuing… TABLE 7

Red Blood Cells Phospholipids Fatty Acids Profile[1]

	Diet					Time						Diet *vs* Time
22:6 n3	0,29	0,30	0,27	0,05	0,9401	0,37^{a}	0,34^{ab}	0,21^{b}	0,23^{ab}	0,05	0,0064	0,8284
24:0	1,28	1,13	1,36	0,09	0,2159	0,91^{b}	1,38^{a}	1,27^{a}	1,47^{a}	0,09	0,0009	0,8948
24:1 n9	9,34	8,74	9,80	0,37	0,1369	9,17^{a}	10,2^{a}	8,05^{b}	9,76^{a}	0,37	0,0001	0,3987
Sat	41,0	40,4	42,0	0,66	0,2544	39,7	41,0	41,8	42,0	0,76	0,1346	0,2493
MUFAS	20,2^{b}	19,5^{b}	21,6^{a}	0,41	0,0012	21,1^{ab}	21,9^{a}	19,0^{c}	19,7^{bc}	0,41	0,0001	0,0582
PUFAS	37,5	38,9	35,2	0,75	0,0117	36,4	35,9	39,1	37,4	0,86	0,0422	0,0297
HUFAS	13,4	10,9	11,6	0,36	0,0007	13,2	10,7	12,0	12,0	0,48	0,0001	0,0003
UI	1,25	1,35	1,24	0,26	0,8863	2,77	1,27	0,06	1,01	1,16	0,0001	0,7660

[1] Values are means, GLA diet (*n* = 10), HL diet (*n* = 9) and LL diet (*n* = 9); Superscript letters not in common indicate a significant difference between diets and time ANOVA, P < 0.05; NI=non statistical; SAT =sum of all saturated FA; MUFAS=sum of all FA with one double bond; PUFAS=sum of all FA with more than 2 double bonds; HUFAS=sum of all FA with more than 4 double bonds; UI = No identified FA.

TABLE 8

Cats Red Blood Cells Phospholipids Membranes (Relative %)[1]

	GLA (n=10)				HL (n=9)				LL (n=9)			
Fatty Acids	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8
12:0	0,01±0,01	0,07±0,03	0,07±0,02	0,11±0,03	0,013±0,0	0,03±0,02	TR	0,03±0,01	0,01±0,0	0,07±0,04	0,07±0,04	0,88±0,04
14:0	0,25±0,02^{a1}	0,63±0,05^{b12}	0,67±0,03^{b2}	0,67±0,09^{b12}	0,21±0,01^{a1}	0,35±0,06^{ab1}	0,38±0,03^{b1}	0,51±0,06^{b1}	0,24±0,02^{a1}	0,72±0,09^{b2}	0,85±0,06^{b2}	0,88±0,06^{b2}
15:0	0,12±0,02	0,05±0,02	0,02±0,02	TR	0,15±0,01	0,04±0,02	TR	TR	0,14±0,02	0,05±0,03	TR	TR
16:0	20,2±0,84	22,1±0,94	21,7±0,39	20,1±0,59	20,2±0,97	20,6±0,35	21,3±0,82	20,2±0,99	19,5±0,77	23,4±1,40	22,9±1,62	21,1±0,69
16:1 n7	0,32±0,03	0,34±0,07	0,30±0,04	0,30±0,04	0,34±0,03	0,26±0,07	0,34±0,03	0,27±0,04	0,32±0,03	0,41±0,10	0,38±0,03	0,40±0,04
17:0	0,73±0,07	0,51±0,02	0,43±0,02	0,62±0,17	0,71±0,03	0,73±0,24	0,50±0,01	0,92±0,49	0,61±0,06	0,58±0,16	0,48±0,03	0,37±0,04
18:0	16,3±0,48	14,9±0,52	15,8±0,28	17,9±0,70	16,8±0,59	14,2±0,30	16,5±0,50	17,3±0,90	15,8±0,54	15,7±0,70	16,6±0,62	17,1±0,49
18:1 n9	7,60±0,23	7,18±0,34	7,30±0,14	6,43±0,18	7,59±0,16	7,39±0,18	6,81±0,13	6,04±0,23	8,14±0,18	7,33±0,50	7,57±0,39	7,15±0,39
18:1 n7	3,20±0,30	3,17±0,51	2,68±0,09	2,35±0,21	2,91±0,31	2,85±0,13	2,79±0,18	2,96±0,66	3,02±0,25	4,24±0,56	2,99±0,12	2,55±0,36
18:2 n6	18,6±0,78^{a1}	19,0±0,98^{a1}	19,8±0,34^{a1}	17,3±0,41^{a1}	20,5±0,62^{a1}	26,3±0,62^{b2}	26,6±0,37^{b2}	24,7±1,87^{ab2}	19,9±0,44^{a1}	18,8±1,58^{a1}	21,2±1,20^{a1}	20,8±1,12^{a12}
18:3 n6	0,06±0,04^{a1}	0,44±0,06^{b2}	0,47±0,08^{b2}	0,62±0,06^{b2}	0,03±0,02^{a1}	0,08±0,09^{a12}	0,03±0,03^{a1}	0,19±0,19^{a12}	0,06±0,02^{a1}	0,07±0,07^{a1}	TR^{a1}	TR^{a1}
18:3 n3	0,18±0,04	0,17±0,04	0,29±0,07	0,22±0,05	0,22±0,03	0,15±0,05	0,09±0,04	0,19±0,05	0,23±0,04	0,16±0,05	0,23±,06	0,16±0,06
20:0	0,61±0,04	0,49±0,05	0,39±0,01	0,27±0,04	0,54±0,03	0,48±0,02	0,45±0,04	0,43±0,04	0,52±0,02	0,73±0,14	0,49±0,05	0,28±0,05
20:1 n9	0,55±0,02	0,41±0,05	0,47±0,02	0,33±0,05	0,53±0,04	0,53±0,03	0,51±0,04	0,39±0,03	0,62±0,02	0,55±0,06	0,48±0,07	0,37±0,06
20:2 n6	0,85±0,05^{a1}	0,75±0,02^{a1}	0,75±0,02^{a1}	0,64±0,07^{a1}	0,95±0,07^{a1}	1,10±0,05^{ab2}	1,20±0,06^{b2}	1,14±0,11^{ab2}	0,96±0,04^{a1}	0,82±0,05^{a1}	0,93±0,06^{a1}	0,73±0,08^{a12}
20:3 n6 (5)[2]	1,10±0,11	1,04±0,08	1,10±0,06	0,97±0,13	1,28±0,10	1,15±0,17	1,54±0,12	1,55±0,18	1,41±0,09	1,08±0,14	1,45±0,11	1,43±0,15
20:3 n6 (8)[3]	1,39±0,11^{a1}	2,57±0,17^{b1}	3,73±0,13^{c1}	4,43±0,19^{d1}	0,86±0,15^{a1}	0,78±0,12^{a2}	0,77±0,08^{a2}	0,52±0,06^{a2}	0,87±0,05^{a1}	0,77±0,06^{a2}	1,11±0,10^{a2}	0,93±0,07^{a2}
20:4 n6	11,4±0,47^{a1}	10,4±0,57^{b1}	12,1±0,36^{ab1}	13,4±0,50^{a1}	11,1±0,58^{a1}	8,90±0,35^{b1}	9,56±0,78^{ab1}	8,35±0,66^{b2}	11,6±0,33^{a1}	8,47±0,74^{b1}	10,2±0,74^{ab1}	10,5±0,60^{ab2}
20:5 n3	0,31±0,02	0,15±0,05	0,20±0,07	0,09±0,05	0,37±0,05	0,10±0,04	0,08±0,03	0,17±0,12	0,41±0,03	0,19±0,05	0,33±0,10	0,22±0,14
22:0	0,95±0,04	0,77±0,08	0,57±0,10	0,79±0,04	0,91±0,05	0,71±0,10	0,66±0,04	0,79±0,13	0,85±0,07	0,94±0,05	0,65±0,10	0,64±0,16
22:1 n9	0,18±0,04	0,26±0,08	0,05±0,03	0,08±0,03	0,27±0,03	0,19±0,04	0,06±0,04	0,11±0,04	0,23±0,02	0,22±0,04	0,13±0,05	0,09±0,04
22:4 n6	0,97±0,04	1,11±0,15	1,22±0,07	1,05±0,06	0,77±0,11	0,75±0,05	0,88±0,05	0,80±0,23	0,94±0,07	0,77±0,09	0,95±0,14	0,67±0,08
22:5 n3	0,14±0,04	0,17±0,04	0,03±0,03	TR	0,26±0,05	0,11±0,03	0,04±0,04	TR	0,16±0,03	0,09±0,04	0,03±0,03	TR

Continuing… TABLE 8

Cats Red Blood Cells Phospholipids Membranes (Relative %)[1]

	GLA (n=10)				HL (n=9)				LL (n=9)			
Fatty Acids	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8	Week 0	Week 2	Week 4	Week 8
22:6 n3	0,33±0,05	0,35±0,06	0,22±0,07	0,27±0,20	0,39±0,05	0,33±0,07	0,17±0,05	0,33±0,20	0,39±0,03	0,35±0,13	0,25±0,05	0,01±0,07
24:0	1,05±0,23	1,47±0,13	1,32±0,05	1,29±0,20	0,71±0,09	1,20±0,08	1,12±0,07	1,48±0,25	0,96±0,17	1,48±0,15	1,37±0,07	1,63±0,27
24:1 n9	10,2±0,51	10,3±0,54	8,26±0,29	8,64±0,88	8,26±0,57	9,68±0,40	7,47±0,39	9,54±1,24	9,05±0,46	10,6±0,61	8,42±0,29	11,1±1,25
Sat	40,1±1,34	41,0±1,53	41,0±0,27	41,9±0,88	40,3±1,33	38,4±0,64	41,1±0,72	41,7±1,32	38,7±1,11	43,7±2,14	43,4±2,26	42,3±0,73
MUFAS	22,1±0,53	21,5±0,64	19,0±0,33	18,1±0,88	19,9±0,39	20,9±0,49	17,9±0,46	19,3±1,27	21,4±0,43	23,4±0,64	20±0,28	21,7±1,22
PUFAS	35,5±1,31	36,2±1,87	39,8±0,42	38,7±0,79	36,8±0,94	39,8±0,44	40,9±0,93	37,9±1,77	36,9±0,71	31,6±2,59	36,7±2,19	35,5±1,37
HUFAS	13,1±0,53^{ab1}	12,2±0,73^{b1}	13,7±0,42^{ab2}	14,8±0,45^{a2}	12,9±0,69^{a1}	10,2±0,33^{b1}	10,7±0,84^{ab1}	9,65±0,55^{b1}	13,5±0,34^{a1}	9,87±,83^{b1}	11,7±0,81^{ab12}	11,5±0,63^{ab1}
UI	2,30±0,55	1,29±0,47	0,10±0,12	1,32±0,28	2,99±0,64	1,18±0,46	0,17±0,06	1,06±0,25	3,03±0,51	1,35±0,40	0,08±0,14	0,67±0,18

[1] Values are means ± SEM, GLA diet (*n* = 10), HL diet (*n* = 9) and LL diet (*n* = 9); Superscript letters not in common in a row within a diet group indicate a significant difference between weeks by ANOVA, $p < 0.05$ and superscript numbers not in common in a row within a week indicate a significant difference between diets by ANOVA, $p < 0.05$; Fatty Acid 20:3 n6 (Δ5,11,14), Fatty acid 20:3 n6 (Δ8,11,14). TR = Trace (<0.01); SAT =sum of all saturated FA; MUFAS=sum of all FA with one double bond; PUFAS=sum of all FA with more than 2 double bonds; HUFAS=sum of all FA with more than 4 double bonds; UI = non identified FA.

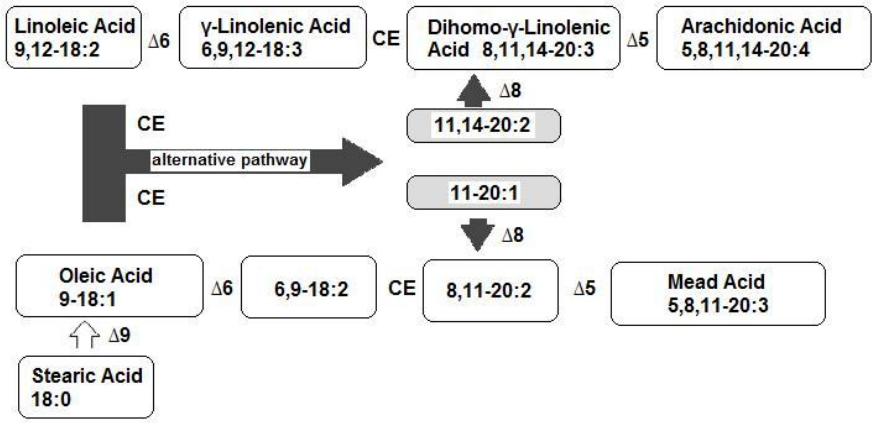

FIGURE 1 – The normal via to produce AA and Mead Acid (MA) is represented in the lines. The alternative pathway is represented in gray arrows. Linoleic and Oleic Acid undergo first by carbon elongase enzyme (CE) action and then Δ8 and Δ5 desaturase to form AA and MA (Adapted from Sinclair, 1979).

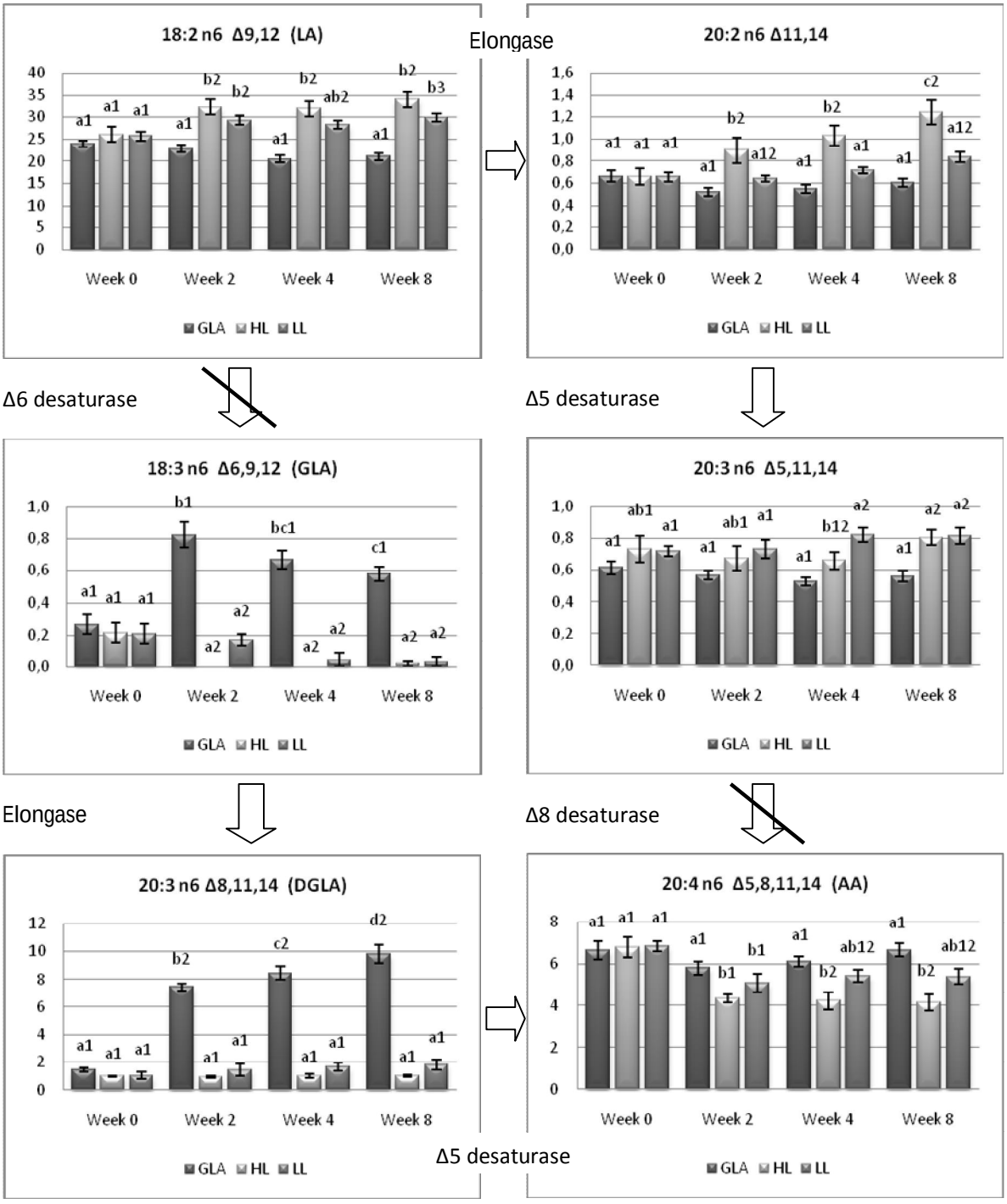

FIGURE 2 – Behavior of different fatty acids in plama phospholipids according to the diet.
Superscript letters not in common within a diet group indicate a significant difference between weeks by ANOVA, $P < 0.05$ and superscript numbers not in common within a week indicate a significant difference between diets by ANOVA, $P < 0.05$

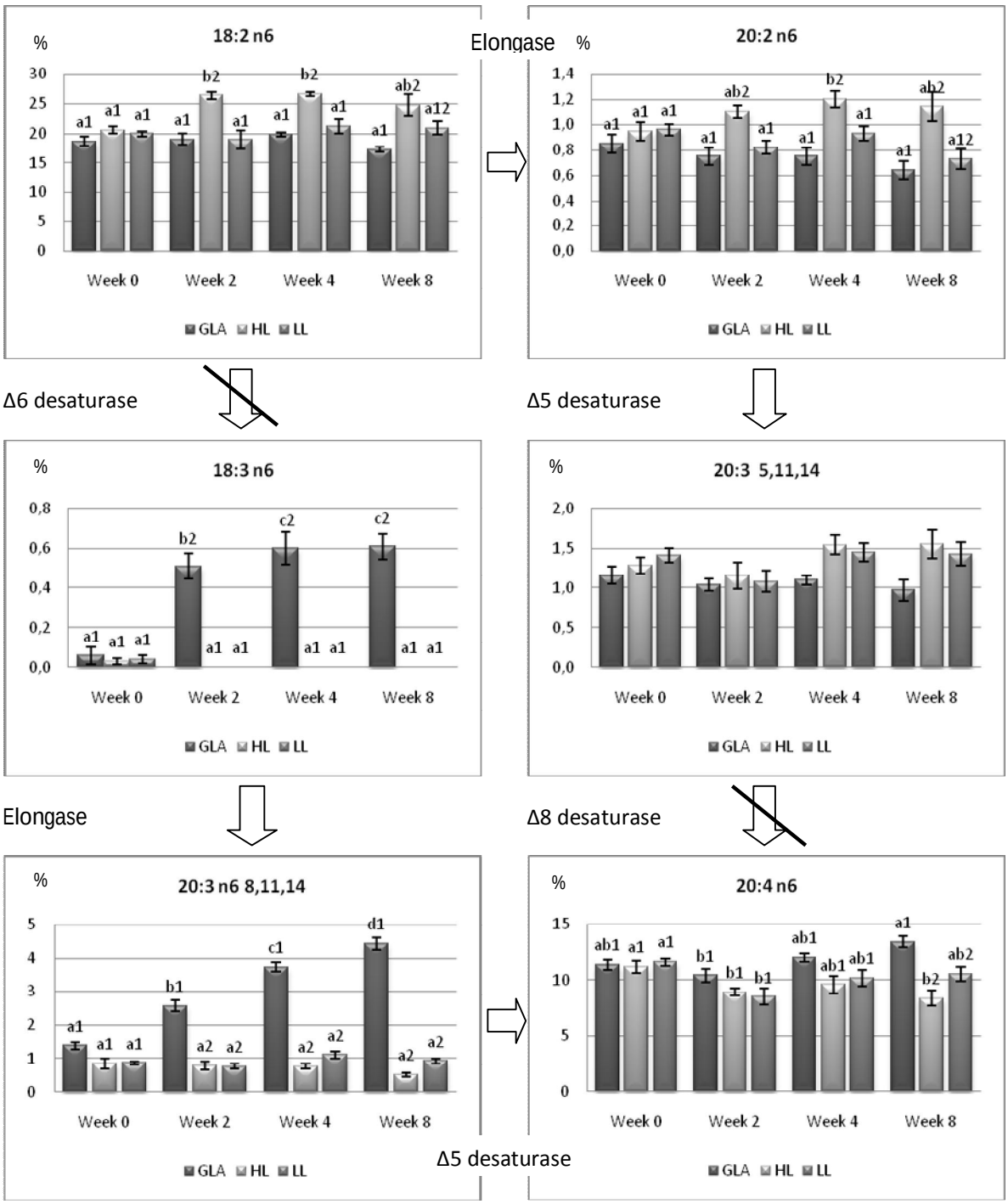

FIGURE 3 – Behavior of different fatty acids in red blood cells phospholipids according to the diet. Superscript letters not in common within a diet group indicate a significant difference between weeks by ANOVA, $P < 0.05$ and superscript numbers not in common within a week indicate a significant difference between diets by ANOVA. $P< 0.05$

CAPÍTULO IV

4.1 Conclusões/Considerações finais

A pesquisa em felinos tem sido um desafio para os pesquisadores desde a década de 70. Felinos, conhecidos pelo comportamento agressivo, apresentam restrições à pesquisa em ambientes laboratoriais. Cães, ratos e camundongos têm sido preferencialmente utilizados nas pesquisas, como modelos experimentais, escolhidos principalmente pela docilidade de manejo e suas características metabólicas, que serviram de modelo para estudos em diferentes espécies. Os gatos, por sua vez, não se ajustaram como modelos experimentais. Suas particularidades nutricionais e a dificuldade de aceitação às dietas purificadas foram um empecilho para que isso acontecesse.

Atualmente, a pesquisa em felinos foi facilitada pela criação de animais SPF (*Specific Patogen Free*). Por outro lado, os aspectos comportamentais indesejados referentes à espécie ainda representam uma barreira para experimentos em nutrição, quando coletas de amostras de sangue são inevitáveis. Pela experiência adquirida durante os experimentos conduzidos, pode-se dizer que o contato no dia a dia com os animais melhora a socialização e facilita o manejo. Métodos de coleta de sangue e sedativos podem facilitar este processo. Gatos apresentam coagulação sanguínea rápida, e é necessária habilidade por parte dos coletores para a obtenção de amostras significativas e íntegras. Este procedimento somente é possível se houver uma equipe treinada. A contenção do animal é parte do sucesso do procedimento. O animal deve sentir-se confortável, em um ambiente sem ruído. O coletor deve ter experiência na manipulação de animais, caso contrário podem acontecer acidentes, como mordidas,

arranhaduras e a consequente obtenção de amostras de baixa qualidade, o que impossibilita sua utilização. Em experimentos em que o sangue é dividido em alíquotas, plasma e células vermelhas, não pode haver a contaminação. A ruptura das hemácias ou células brancas do sangue liberam o conteúdo interno e contaminam as amostras de plasma, afetando a concentração de lipídeos plasmáticos.

Felídeos, por se tratarem de um grupo de animais carnívoros estritos, apresentam significativas particularidades metabólicas, especialmente no metabolismo lipídico. Os gatos revelam versatilidade em metabolizar estes componentes, podendo os mesmos tornarem-se elemento chave no estudo dos transtornos do colesterol e doenças ateromatosas em humanos. A porção “α” das lipoproteínas plasmáticas, que corresponde ao HDL, é naturalmente elevada nos carnívoros. O aumento do HDL é proporcional à ingestão de lipídeos, forma de proteção natural contra doenças cardiovasculares, inerente aos felídeos, contrário ao que normalmente ocorre em humanos.

Muitas questões permanecem sem resposta sobre o metabolismo desta espécie. Os resultados observados no Capítulo II, atestam que gatos podem consumir TCM sem recusa alimentar e sem alterações significativas no metabolismo lipídico, contrariando resultados conhecidos até então, a respeito da aceitação de AGCM por gatos. Em uma breve revisão sobre os produtos encontrados no Brasil e nos EUA, destinados a alimentação de gatos, não foi possível encontrar a inclusão de ingredientes como óleo de coco compondo dietas para gatos, provavelmente em função da publicação de McDonald et al. feita há 24 anos. Além disso, diversos trabalhos relatam

alterações lipídicas no metabolismo, como hipertrigliceridemia e hipercolesterolemia em animais alimentados com inclusões elevadas de TCM (>22% da EM). Neste estudo, houve um aumento imediato da concentração de triglicerídeos e lipoproteínas, logo após o início da fase experimental, devido à composição elevada de gordura dietética, quando comparada à dieta consumida no período pré-experimental. No entanto, após 4 semanas, os parâmetros plasmáticos começaram a decrescer, retornando aos níveis basais, demonstrando a versatilidade do sistema enzimático dos carnívoros em adaptar-se ao consumo constante de uma dieta. Este experimento suscita a hipótese de que os efeitos observados na literatura, quando dietas purificadas foram confeccionadas e testadas, não são necessariamente reproduzidos com dietas práticas. A sensibilidade felina pelo sabor é conhecida e este pode ter sido o fator determinante afetando o consumo das dietas purificadas. Possivelmente pelo sabor repugnante proporcionado pelos ácidos graxos livres, ainda quando o alimento se encontrava na boca dos animais. O uso de dietas práticas para a experimentação, em que há interação entre os ingredientes das fórmulas, é de fundamental importância no estudo de ingredientes específicos em dietas comerciais. Os processos térmicos, de uma forma geral, tendem a modificar a palatabilidade dos alimentos. No processo de extrusão a temperatura e umidade, associados à pressão, podem ter impacto maior ou menor sobre os ingredientes. As reações de tipo Maillard e outras modificam a palatabilidade do alimento, assim como a estrutura dos nutrientes. Dessa forma, diferentes ingredientes afetam a aceitabilidade e a digestibilidade das dietas nas diferentes espécies e categorias e devem ser testados antes da inclusão definitiva.

No Capítulo III, foram pesquisadas as interações entre a suplementação de ácido γ-linolênico (GLA) e a atividade da enzima Δ6 dessaturase no metabolismo lipídico dos gatos. De acordo com uma série de experimentos prévios, gatos não apresentam significante atividade dessa enzima. Neste trabalho, a análise do perfil de lipídeos plasmáticos e do perfil de lipídeos das membranas plasmáticas das células vermelhas revelou a proximidade entre a concentração das dietas e o perfil de ácidos graxos encontrados nos tecidos, fato consolidado na literatura. A suplementação de ácido linolêico (AL), mesmo em altas concentrações, não foi eficiente para induzir a ação da Δ6 desaturase ou induzir uma via alternativa para a produção de ácido araquidônico (AA). O óleo de borragem como fonte de GLA, no entanto, foi capaz de permitir a manutenção dos níveis elevados de AA nos tecidos. Dessa forma a suplementação de AL em dietas para gatos somente é necessária para o atendimento das necessidades do próprio ácido. No entanto, não é uma fonte para a síntese de AA, como ocorre com o GLA.

O AA é essencial para gatos, especialmente em categorias de maior demanda como animais jovens, fêmeas em lactação e reprodução, observação esta descrita no NRC (2006). As fêmeas respondem mais rapidamente à deficiência, com problemas reprodutivos, mas machos adultos privados de AA não apresentam prejuízos na taxa reprodutiva. O AA, junto com o ácido esteárico, são usualmente os únicos componentes da fosfatidil inositol (Berg et al., 2004), uma provável razão para sua alta concentração nos fosfolipideos plasmáticos (em torno dos 6%) e nas membranas dos eritrócitos (em torno de 10%). Uma questão a ser melhor explicada é a origem destas altas concentrações, uma vez conhecida a deficiência da atividade da

enzima Δ6 dessaturase em gatos e a baixa concentração dietética usual de AA (<0,03% para dietas de 4000 kcal EM). Neste contexto mais estudos são necessários para estabelecer se há alguma via alternativa ou se o AA possui outra forma de recuperação para que tais concentrações sejam mantidas.

Este estudo também demonstra que a inclusão de um ingrediente alternativo, o óleo de borragem, foi capaz de manter as concentrações de AA nos tecidos. As fontes tradicionais de AA são as gorduras presentes nos ingredientes de origem animal. Dietas para gatos, livres desses ingredientes, seriam certamente deficientes em AA, entre outros nutrientes. O óleo de borragem, como suplemento de origem vegetal, teria potencial para atender as necessidades de AA dos gatos.

O GLA, além de servir como substrato para a síntese de AA, ainda promove a pronta acumulação nas membranas do seu derivado DGLA, em menos de 14 dias após o início da suplementação. Devido às propriedades que os ácidos graxos poli-insaturados de 20 carbonos possuem de gerar eicosanóides, prostaglandianas e tromboxanos, o GLA pode ter importância significativa na modulação da resposta imune, já que ele rapidamente é elongado ao DGLA, fator este muito pouco estudado em felídeos. Eicosanóides provenientes do DGLA possuem características menos inflamatórias que aqueles normalmente gerados pelo AA. Dessa forma, uma das ações complementares deste estudo será submeter as amostras de plasma a novas metodologias, como o laser e espectrometria de massas, para detectar componentes plasmáticos, que serão correlacionados às dietas experimentais. Estas novas metodologias estão sendo desenvolvidas nos laboratórios da Nestlé Purina em Saint Louis, Estados Unidos (*Luminex* -

Perfil imune por tecnologia a laser) e no outro laboratório da Nestlé Purina em Lausanne, Suíça *(Metabolomic profile testing)* para os quais as amostras serão enviadas e submetidas à analise.

Os dois trabalhos que nesta tese foram apresentados são de caráter prático e aplicável a dietas específicas para gatos. Pelas características dos ingredientes, óleos de coco e de borragem, abre-se a possibilidade da utilização dos mesmos em dietas normais ou dietas terapêuticas para gatos. A inclusão de 11% EM na forma de TCM não afeta o consumo e não causa recusa alimentar. Para animais com síndrome de malabsorção, ou problemas pancreáticos em que a digestão de lipídeos esteja prejudicada, a inclusão de TCM pode representar uma fonte de energia disponível, prática e barata na dietas de felinos. O GLA por sua vez, acrescido na dieta como componente do óleo de borragem, pode ser uma fonte para a síntese do AA, proporcionando acumulação de DGLA nas membranas, fato que pode ter implicações positivas no sistema imunológico.

CAPÍTULO V

5.1 Referências Bibliográficas

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6 APENDICES

Apêndice 01 – Dados do consumo de alimento na matéria natural (Cons), peso corporal (W), escore de condição corporal (Score), consumo de energia por semana em kcal por animal (EM kcal/week), relação entre o consumo de energia e a massa corporal (MER)

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Apple	GLA	0	68	3,76	5	1861	106
Apricot	GLA	0	50	2,40	4	1363	106
Chevell	GLA	0	56	2,72	4	1485	106
Ferrari	GLA	0	78	4,58	8	2061	106
Kiwi	GLA	0	70	4,22	7	1814	98
Lynx	GLA	0	62	3,22	5	1613	101
Marigol	GLA	0	70	3,72	5	1749	102
Mulan	GLA	0	46	2,27	4	1172	100
Lavender	GLA	0	83	4,67	6	2007	94
Mystiqu	GLA	0	55	3,36	5	1340	83
Apple	GLA	1	66	3,86	5	1876	108
Apricot	GLA	1	48	2,49	4	1371	106
Chevell	GLA	1	53	2,77	4	1507	109
Ferrari	GLA	1	63	4,72	8	1791	91
Kiwi	GLA	1	68	4,26	6	1950	105
Lynx	GLA	1	59	3,31	5	1697	108
Marigol	GLA	1	66	3,81	5	1876	110
Mulan	GLA	1	47	2,36	4	1339	107
Lavende	GLA	1	74	4,72	6	2131	107
Mystiqu	GLA	1	61	3,40	5	1742	110
Apple	GLA	2	66	3,76	5	1876	111
Apricot	GLA	2	51	2,49	4	1472	114
Chevell	GLA	2	53	2,68	4	1507	112
Ferrari	GLA	2	64	4,63	8	1821	93
Kiwi	GLA	2	67	4,22	7	1926	105
Lynx	GLA	2	59	3,18	5	1692	112
Marigol	GLA	2	64	3,72	5	1826	108
Mulan	GLA	2	51	2,31	4	1453	119
Lavende	GLA	2	73	4,72	6	2092	105
Mystiqu	GLA	2	57	3,36	5	1628	103
Apple	GLA	3	66	3,81	5	1876	110
Apricot	GLA	3	53	2,49	4	1521	118
Chevell	GLA	3	53	2,63	4	1507	113
Ferrari	GLA	3	62	4,54	8	1776	92
Kiwi	GLA	3	69	4,26	7	1987	107
Lynx	GLA	3	57	3,13	5	1628	108
Marigol	GLA	3	65	3,67	5	1873	112
Mulan	GLA	3	56	2,36	5	1604	129
Lavende	GLA	3	74	4,63	6	2131	110
Mystiqu	GLA	3	61	3,31	5	1742	112

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Apple	GLA	4	66	3,81	5	1876	110
Apricot	GLA	4	53	2,49	4	1510	117
Chevell	GLA	4	53	2,63	4	1507	113
Ferrari	GLA	4	62	4,45	8	1776	93
Kiwi	GLA	4	63	4,31	6	1817	97
Lynx	GLA	4	59	3,13	5	1697	113
Marigol	GLA	4	63	3,63	5	1812	110
Mulan	GLA	4	53	2,36	4	1510	121
Lavende	GLA	4	74	4,72	6	2117	107
Mystiqu	GLA	4	59	3,27	5	1681	109
Apple	GLA	5	66	3,81	5	1876	110
Apricot	GLA	5	52	2,54	5	1503	115
Chevell	GLA	5	53	2,59	4	1507	114
Ferrari	GLA	5	62	4,45	7	1776	93
Kiwi	GLA	5	69	4,35	6	1962	104
Lynx	GLA	5	59	3,04	5	1697	115
Marigol	GLA	5	61	3,58	5	1751	106
Mulan	GLA	5	56	2,45	4	1595	125
Lavende	GLA	5	74	4,67	6	2131	109
Mystiqu	GLA	5	60	3,27	5	1706	111
Apple	GLA	6	64	3,81	5	1840	107
Apricot	GLA	6	49	2,54	4	1406	107
Chevell	GLA	6	53	2,59	4	1507	114
Ferrari	GLA	6	62	4,35	8	1776	95
Kiwi	GLA	6	67	4,31	7	1931	103
Lynx	GLA	6	59	3,04	5	1697	115
Marigol	GLA	6	65	3,54	5	1849	114
Mulan	GLA	6	55	2,40	4	1575	125
Lavende	GLA	6	74	4,63	5	2130	110
Mystiqu	GLA	6	61	3,27	5	1742	113
Apple	GLA	7	65	3,81	5	1865	109
Apricot	GLA	7	50	2,63	4	1438	107
Chevell	GLA	7	53	2,59	4	1507	114
Ferrari	GLA	7	62	4,31	7	1776	95
Kiwi	GLA	7	66	4,40	6	1893	100
Lynx	GLA	7	59	3,04	5	1697	115
Marigol	GLA	7	65	3,54	5	1854	114
Mulan	GLA	7	52	2,40	4	1488	118
Lavende	GLA	7	74	4,67	6	2131	109
Mystiqu	GLA	7	61	3,31	5	1738	112
Apple	GLA	8	66	3,81	5	1876	110
Apricot	GLA	8	52	2,59	4	1496	113
Chevell	GLA	8	53	2,54	4	1507	116
Ferrari	GLA	8	62	4,31	7	1776	95
Kiwi	GLA	8	61	4,35	6	1756	94

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Lynx	GLA	8	59	2,99	5	1697	117
Marigol	GLA	8	58	3,45	5	1666	104
Mulan	GLA	8	51	2,40	4	1458	116
Lavende	GLA	8	73	4,63	5	2080	106
Mystiqu	GLA	8	61	3,27	5	1742	113
Aphrodi	HL	0	51	2,49	5	1351	103
Artemis	HL	0	70	4,04	5	1857	103
Aurora	HL	0	52	2,77	5	1348	95
Ginger	HL	0	55	2,77	5	1397	99
Jasmine	HL	0	65	3,45	5	1621	100
Lilac	HL	0	63	3,13	5	1566	102
Mimosa	HL	0	72	3,72	5	1742	102
Nala	HL	0	44	3,72	6	1060	61
Tulip	HL	0	.	5,44	7	2224	101
Zephyr	HL	0	60	3,04	5	1404	94
Aphrodi	HL	1	49	2,49	4	1362	105
Artemis	HL	1	66	4,08	5	1835	102
Aurora	HL	1	53	2,81	4	1474	105
Ginger	HL	1	53	2,77	4	1473	106
Jasmine	HL	1	61	3,49	5	1680	104
Lilac	HL	1	58	3,13	5	1597	106
Mimosa	HL	1	64	3,72	5	1787	106
Nala	HL	1	46	3,72	6	1274	75
Tulip	HL	1	83	5,44	5	2295	105
Zephyr	HL	1	47	3,04	5	1306	89
Aphrodi	HL	2	56	2,40	4	1555	123
Artemis	HL	2	68	3,95	5	1872	107
Aurora	HL	2	51	2,72	5	1413	103
Ginger	HL	2	53	2,72	5	1474	108
Jasmine	HL	2	60	3,36	5	1659	105
Lilac	HL	2	58	3,13	5	1597	106
Mimosa	HL	2	64	3,63	5	1787	108
Nala	HL	2	56	3,72	6	1544	91
Tulip	HL	2	83	5,44	5	2295	105
Zephyr	HL	2	51	2,99	5	1403	96
Aphrodi	HL	3	70	2,49	5	1940	.
Artemis	HL	3	67	3,99	5	1870	106
Aurora	HL	3	53	2,77	5	1474	106
Ginger	HL	3	53	2,72	5	1474	108
Jasmine	HL	3	50	3,31	5	1376	88
Lilac	HL	3	58	3,04	5	1597	108
Mimosa	HL	3	64	3,58	5	1787	109
Nala	HL	3	46	3,72	6	1274	75
Tulip	HL	3	83	5,40	6	2295	106
Zephyr	HL	3	56	3,04	5	1552	105

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Aphrodi	HL	4	70	2,49	5	1940	.
Artemis	HL	4	68	3,95	5	1872	107
Aurora	HL	4	53	2,77	5	1474	106
Ginger	HL	4	53	2,68	5	1474	109
Jasmine	HL	4	57	3,31	5	1585	102
Lilac	HL	4	58	3,04	5	1597	108
Mimosa	HL	4	64	3,54	5	1787	110
Nala	HL	4	39	3,63	6	1068	64
Tulip	HL	4	83	5,44	5	2295	105
Zephyr	HL	4	53	3,04	5	1459	99
Aphrodi	HL	5	70	2,59	5	1940	.
Artemis	HL	5	68	4,04	5	1872	105
Aurora	HL	5	53	2,81	5	1474	105
Ginger	HL	5	53	2,68	5	1474	109
Jasmine	HL	5	57	3,36	5	1571	100
Lilac	HL	5	58	3,04	5	1597	108
Mimosa	HL	5	64	3,45	5	1787	111
Nala	HL	5	51	3,67	5	1415	85
Tulip	HL	5	83	5,35	5	2295	107
Zephyr	HL	5	56	3,04	5	1552	105
Aphrodi	HL	6	70	2,86	5	1940	.
Artemis	HL	6	68	3,95	5	1872	107
Aurora	HL	6	53	2,81	5	1474	105
Ginger	HL	6	53	2,68	5	1474	109
Jasmine	HL	6	60	3,40	5	1671	105
Lilac	HL	6	58	2,95	5	1597	111
Mimosa	HL	6	64	3,49	5	1787	110
Nala	HL	6	49	3,63	5	1372	83
Tulip	HL	6	83	5,40	5	2295	106
Zephyr	HL	6	56	3,04	5	1547	105
Aphrodi	HL	7	60	2,86	5	1663	118
Artemis	HL	7	68	3,95	5	1872	107
Aurora	HL	7	53	2,81	5	1474	105
Ginger	HL	7	53	2,68	4	1474	109
Jasmine	HL	7	58	3,36	5	1594	101
Lilac	HL	7	58	2,95	5	1597	111
Mimosa	HL	7	64	3,40	5	1787	112
Nala	HL	7	50	3,63	5	1397	84
Tulip	HL	7	83	5,40	5	2295	106
Zephyr	HL	7	56	3,08	5	1547	104
Aphrodi	HL	8	60	2,86	5	1663	118
Artemis	HL	8	66	3,95	5	1817	103
Aurora	HL	8	53	2,77	4	1474	106
Ginger	HL	8	53	2,68	4	1474	109
Jasmine	HL	8	59	3,36	5	1626	103

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Lilac	HL	8	58	2,90	5	1597	112
Mimosa	HL	8	64	3,40	5	1787	112
Nala	HL	8	53	3,58	5	1480	90
Tulip	HL	8	83	5,44	5	2295	105
Zephyr	HL	8	51	3,04	5	1420	96
Athena	LL	0	76	4,58	6	2019	103
Guava	LL	0	70	4,04	6	1857	103
Hera	LL	0	71	3,95	5	1832	103
Persimm	LL	0	62	3,31	5	1589	98
Mango	LL	0	70	3,99	5	1748	81
Verbena	LL	0	39	3,27	5	988	102
Perseph	LL	0	53	3,27	5	1284	102
Rajah	LL	0	67	3,31	5	1629	63
Yzma	LL	0	59	2,72	5	1378	98
Athena	LL	1	73	4,58	5	2036	105
Guava	LL	1	67	4,17	6	1870	103
Hera	LL	1	67	4,04	5	1858	104
Persimm	LL	1	58	3,40	5	1603	101
Mango	LL	1	67	4,04	5	1846	104
Verbena	LL	1	56	3,31	5	1555	100
Perseph	LL	1	53	3,27	5	1476	95
Rajah	LL	1	60	3,36	5	1672	106
Yzma	LL	1	49	2,77	5	1357	98
Athena	LL	2	73	4,45	5	2036	107
Guava	LL	2	68	4,13	5	1872	103
Hera	LL	2	67	3,90	5	1858	107
Persimm	LL	2	59	3,36	5	1627	103
Mango	LL	2	66	3,99	5	1826	103
Verbena	LL	2	49	3,22	5	1357	89
Perseph	LL	2	53	3,27	5	1457	94
Rajah	LL	2	60	3,27	5	1672	108
Yzma	LL	2	53	2,72	5	1458	107
Athena	LL	3	73	4,45	7	2036	107
Guava	LL	3	67	4,17	6	1845	101
Hera	LL	3	67	3,90	5	1858	107
Persimm	LL	3	58	3,40	5	1603	101
Mango	LL	3	67	3,99	5	1858	105
Verbena	LL	3	36	3,22	5	993	65
Perseph	LL	3	55	3,31	5	1524	98
Rajah	LL	3	60	3,22	5	1672	109
Yzma	LL	3	53	2,72	5	1458	107
Athena	LL	4	73	4,45	6	2036	107
Guava	LL	4	65	4,17	6	1802	99
Hera	LL	4	67	3,95	5	1858	106
Persimm	LL	4	59	3,40	5	1627	102

Name	Diet	Week	Cons	W	Score	EMkcal/week	Factor
Mango	LL	4	67	3,99	5	1858	105
Verbena	LL	4	53	3,22	5	1462	95
Perseph	LL	4	55	3,27	5	1520	98
Rajah	LL	4	60	3,22	5	1672	109
Yzma	LL	4	50	2,68	5	1397	103
Athena	LL	5	73	4,35	6	2036	109
Guava	LL	5	67	4,22	6	1853	101
Hera	LL	5	67	3,86	5	1855	107
Persimm	LL	5	59	3,45	5	1627	101
Mango	LL	5	65	4,04	5	1810	102
Verbena	LL	5	45	3,22	6	1254	82
Perseph	LL	5	59	3,27	5	1645	106
Rajah	LL	5	60	3,27	5	1672	108
Yzma	LL	5	53	2,68	5	1458	108
Athena	LL	6	73	4,40	6	2036	108
Guava	LL	6	57	4,13	6	1576	87
Hera	LL	6	67	3,86	5	1858	107
Persimm	LL	6	59	3,49	5	1627	101
Mango	LL	6	66	3,99	5	1833	104
Verbena	LL	6	40	3,18	5	1106	73
Perseph	LL	6	60	3,27	5	1657	107
Rajah	LL	6	60	3,22	5	1672	109
Yzma	LL	6	53	2,68	5	1458	108
Athena	LL	7	73	4,35	5	2036	109
Guava	LL	7	57	4,08	6	1574	88
Hera	LL	7	67	3,76	5	1855	109
Persimm	LL	7	59	3,54	5	1627	100
Mango	LL	7	67	3,99	5	1858	105
Verbena	LL	7	56	3,22	5	1557	102
Perseph	LL	7	60	3,31	5	1657	106
Rajah	LL	7	60	3,22	5	1672	109
Yzma	LL	7	53	2,72	5	1458	107
Athena	LL	8	73	4,26	5	2036	110
Guava	LL	8	57	4,08	6	1576	88
Hera	LL	8	67	3,76	5	1858	109
Persimm	LL	8	58	3,58	5	1620	98
Mango	LL	8	59	3,95	5	1632	93
Verbena	LL	8	37	3,18	5	1023	67
Perseph	LL	8	58	3,31	5	1613	103
Rajah	LL	8	60	3,22	5	1672	109
Yzma	LL	8	53	2,68	5	1458	108

Apêndice 02 – Peso corporal, consumo de alimento em gramas e em Kcal consumida por gato por semana e necessidade de energia de mantença considerando as duas dietas (HL ou LMCT e LL ou HMCT)

Body weight

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.29	0.5953
Time	8	136	2.28	0.0257
Diet*Time	8	136	0.34	0.9498

Maintenance energy requirement

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.48	0.4990
Time	8	17	7.37	0.0003
Diet*Time	8	17	0.76	0.6433

Consumption g/cat/day

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.01	0.9398
Time	8	17	5.40	0.0017
Diet*Time	8	17	0.70	0.6901

Apêndice 03 – Peso corporal, consumo de alimento em gramas e em Kcal consumida por gato por semana e necessidade de energia de mantença considerando as três dietas utilizadas no experimento.

Body Weight

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.13	0.8771
Time	8	208	4.40	<.0001
Diet*Time	16	208	0.44	0.9715

Consumption Kcal/week/cat

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.27	0.7677
Time	8	26	2.55	0.0335
Diet*Time	16	26	0.74	0.7307

Consumption g/cat/day

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.02	0.9806
Time	8	207	2.28	0.0235
Diet*Time	16	207	0.67	0.8185

Maintenance energy requirement

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	2.13	0.1386
Time	8	26	5.65	0.0003
Diet*Time	16	26	0.67	0.7961

Apêndice 04 - Dados referentes ao experimento de digestibilidade

Obs	Cat	Diet	Drymater	Protein	Fat	Fiber	CHO	Energy	DE	ME
1	Apple	GLA	87.91	90.85	95.30	17.34	91.68	90.92	4409.50	4159.50
2	Chevel	GLA	84.29	88.35	93.71	-1.43	87.83	87.73	4254.90	4011.80
3	Lynx	GLA	102.14	101.38	100.64	111.08	102.45	101.71	4933.20	4654.20
4	Mulan	GLA	97.18	98.26	98.97	77.70	97.99	97.98	4751.90	4481.50
5	Lavend	GLA	82.81	86.81	94.16	-9.38	85.44	86.52	4196.10	3957.20
6	Mystiq	GLA	84.18	87.53	94.15	-9.58	88.19	87.61	4248.90	4008.00
7	Chevel	GLA	92.39	94.78	97.35	46.70	93.43	94.10	4564.10	4303.20
8	Lynx	GLA	79.67	87.42	94.15	7.26	75.76	84.19	4083.20	3842.70
9	Mulan	GLA	99.64	99.77	99.86	96.94	99.76	99.73	4837.10	4562.60
10	Lavend	GLA	88.31	91.60	96.11	33.97	89.15	90.95	4410.90	4158.80
11	Mystiq	GLA	83.72	88.44	94.57	-9.32	86.30	87.62	4249.50	4006.10
12	Kiwi	GLA	76.95	84.75	90.67	-70.54	84.20	83.15	4032.80	3799.60
13	Marigol	GLA	77.03	84.94	88.58	-68.39	83.99	82.52	4002.30	3768.50
14	Apple	GLA	77.23	84.69	91.31	-61.42	83.36	83.34	4041.80	3808.70
15	Chevel	GLA	85.45	89.92	94.59	9.67	87.52	88.89	4311.00	4063.50
16	Lynx	GLA	81.85	88.50	94.44	11.01	79.15	85.68	4155.40	3911.90
17	Mulan	GLA	94.19	96.27	97.83	54.56	96.07	95.92	4652.10	4387.20
18	Mystiq	GLA	93.76	95.38	97.69	59.12	95.15	95.25	4619.50	4357.10
19	Marigol	GLA	79.75	86.08	92.47	-36.80	84.54	84.96	4120.40	3883.50
20	Ferrari	GLA	79.75	86.46	91.40	-55.59	86.91	85.08	4126.50	3888.50
21	Apricot	GLA	71.64	81.71	88.44	-119.16	79.85	79.15	3838.80	3613.90
22	Apple	GLA	81.21	87.13	93.25	-40.01	86.39	86.13	4177.20	3937.40
23	Chevel	GLA	84.21	87.96	93.18	-6.30	88.87	87.83	4259.60	4017.50
24	Lynx	GLA	86.10	90.53	95.85	28.28	85.51	89.23	4327.40	4078.30
25	Mulan	GLA	104.47	102.86	101.60	136.90	103.21	103.22	5006.20	4723.10
26	Lavend	GLA	76.41	79.91	91.51	-62.32	84.25	82.31	3992.00	3772.10
27	Kiwi	GLA	77.95	85.61	92.17	-83.14	85.72	84.34	4090.70	3855.10
28	Marigol	GLA	92.74	95.04	97.42	52.37	94.07	94.64	4590.00	4328.50
29	Lynx	GLA	89.11	91.64	95.54	26.45	91.56	91.42	4433.90	4181.70
30	Mulan	GLA	94.16	96.02	97.85	52.11	96.06	95.76	4644.20	4380.00
31	Lavend	GLA	88.72	91.78	96.17	30.67	90.67	91.68	4446.30	4193.80
32	Mystiq	GLA	81.81	86.24	93.73	-33.88	87.44	86.72	4205.80	3968.50
33	Kiwi	GLA	84.59	89.63	94.77	-17.22	88.53	88.84	4308.90	4062.20
34	Marigol	GLA	93.10	95.08	97.59	52.49	94.30	94.81	4598.20	4336.50
35	Ferrari	GLA	74.81	83.00	89.29	-92.67	83.30	81.58	3956.60	3728.20
36	Apricot	GLA	86.64	91.54	93.95	-7.33	91.48	90.23	4376.00	4124.10
37	Aphrod	HL	80.15	83.55	85.88	-20.10	86.33	82.55	3970.69	3736.44
38	Artemis	HL	81.22	86.83	91.38	-25.69	84.76	85.23	4099.71	3856.29
39	Aurora	HL	91.40	93.90	96.13	37.14	93.50	93.36	4490.42	4227.17
40	Ginger	HL	81.60	86.33	91.08	-35.03	86.36	85.39	4107.21	3865.17
41	Jasmine	HL	86.47	89.98	93.88	17.58	87.30	88.86	4274.00	4021.73
42	Tulip	HL	87.91	91.18	94.38	16.14	90.30	90.36	4346.41	4090.76
43	Zepher	HL	97.69	98.45	98.77	82.52	98.24	97.68	4698.29	4422.29
44	Aphrod	HL	78.96	83.59	84.82	-15.20	83.80	81.61	3925.43	3691.07
45	Artemis	HL	86.80	90.86	94.43	0.39	89.79	90.07	4332.36	4077.62
46	Aurora	HL	86.67	91.77	95.22	0.58	88.86	90.42	4349.13	4091.84
47	Ginger	HL	83.15	87.47	92.41	-27.80	87.85	86.71	4170.75	3925.52
48	Jasmine	HL	74.72	78.00	86.73	-29.34	79.01	77.97	3750.48	3531.81
49	Tulip	HL	73.58	80.40	85.69	-93.94	69.65	82.56	4796.97	4571.57
50	Zepher	HL	76.73	85.42	87.44	-99.22	77.24	82.70	3978.00	3738.53
51	Lilac	HL	72.61	82.76	88.58	-110.28	77.70	79.70	3833.66	3601.64
52	Mimosa	HL	62.23	75.80	85.61	-144.63	64.45	71.36	3432.44	3219.91
53	Nala	HL	63.92	74.69	82.93	-167.11	74.20	72.66	3494.84	3285.44

Obs	Cat	Diet	Drymater	Protein	Fat	Fiber	CHO	Energy	DE	ME
54	Aphrod	HL	82.35	85.26	86.68	8.33	87.52	84.51	4064.99	3825.95
55	Aurora	HL	97.39	98.21	98.91	80.26	97.99	98.05	4716.37	4441.02
56	Ginger	HL	83.13	87.42	92.12	-22.77	87.39	86.74	4172.42	3927.32
57	Jasmine	HL	84.13	86.45	93.99	18.63	85.60	87.30	4199.00	3956.63
58	Tulip	HL	86.18	89.52	94.40	26.48	86.62	88.93	4277.36	4026.37
59	Zepher	HL	96.59	97.85	98.18	75.21	97.27	97.36	4683.25	4408.92
60	Aphrod	HL	80.60	84.67	87.96	-8.93	84.99	83.69	4025.30	3787.91
61	Artemis	HL	77.13	84.38	89.60	-45.51	80.85	82.37	3961.81	3725.25
62	Aurora	HL	93.92	95.82	97.44	57.97	95.14	95.43	4589.97	4321.34
63	Jasmine	HL	77.90	81.52	91.04	-20.81	80.89	82.39	3962.87	3734.33
64	Tulip	HL	92.64	94.70	95.58	29.83	89.08	91.52	4402.13	2704.60
65	Zepher	HL	90.18	93.70	96.08	28.94	91.92	92.84	4465.71	4362.49
66	Lilac	HL	81.19	88.20	92.23	-40.11	84.35	85.97	4134.94	3887.66
67	Mimosa	HL	84.27	90.11	93.44	-18.74	86.67	88.33	4248.45	3995.82
68	Aphrod	HL	74.66	78.65	90.01	-85.04	81.65	78.09	3756.06	3535.55
69	Artemis	HL	89.64	92.72	95.60	25.32	92.00	92.23	4436.28	4176.33
70	Aurora	HL	84.08	89.10	93.55	-15.79	88.06	88.44	4254.06	4004.27
71	Ginger	HL	75.35	82.38	90.24	-78.49	80.56	81.23	3907.00	3676.04
72	Jasmine	HL	85.92	88.25	92.40	22.56	88.23	88.09	4237.30	3989.89
73	Tulip	HL	87.84	90.91	94.97	31.18	89.02	90.58	4356.99	4102.12
74	Zepher	HL	95.50	97.07	98.12	68.24	96.25	96.65	4648.81	4376.66
75	Lilac	HL	89.32	93.22	95.67	16.84	91.64	92.16	4432.92	4171.57
76	Nala	HL	86.57	90.26	94.08	-4.66	91.01	90.05	4331.50	4078.46
77	Guava	LL	83.93	89.62	94.08	-14.44	87.18	88.08	4245.70	3999.00
78	Rajah	LL	90.73	93.70	96.15	35.42	93.01	93.12	4488.60	4230.70
79	Yzma	LL	79.80	84.78	91.62	-39.75	86.59	84.88	4091.40	3858.10
80	Guava	LL	93.86	96.00	97.45	48.96	95.75	95.44	4600.30	4336.10
81	Yzma	LL	94.33	96.36	97.64	56.13	96.10	95.84	4619.70	4354.50
82	Hera	LL	69.85	77.95	88.36	-115.41	77.60	77.37	3729.10	3514.60
83	Persimm	LL	83.38	88.87	92.70	-28.68	89.86	87.89	4236.30	3991.70
84	Mango	LL	79.33	86.04	89.75	-43.28	86.23	84.80	4087.20	3850.40
85	Verbena	LL	90.86	94.04	95.64	23.82	94.37	93.33	4498.30	4239.60
86	Perseph	LL	90.86	93.70	96.17	31.96	93.72	93.31	4497.40	4239.60
87	Athena	LL	76.62	84.69	93.04	-37.75	77.01	82.30	3966.70	3733.60
88	Mango	LL	73.37	82.94	89.72	-69.01	77.40	80.38	3874.50	3646.20
89	Rajah	LL	72.27	81.49	88.91	-99.03	80.20	79.99	3855.60	3631.30
90	Guava	LL	84.02	90.27	92.95	-33.01	88.98	88.22	4252.10	4003.70
91	Yzma	LL	82.78	88.49	93.42	-24.63	87.45	87.46	4215.40	3971.90
92	Hera	LL	69.61	77.71	88.51	-102.73	76.13	77.02	3712.50	3498.70
93	Persimm	LL	74.43	83.62	89.77	-99.87	80.72	81.06	3906.90	3676.80
94	Verbena	LL	96.65	97.85	98.74	71.75	97.66	97.58	4703.20	4433.90
95	Perseph	LL	74.83	84.12	90.15	-75.44	80.60	81.63	3934.50	3703.00
96	Athena	LL	78.97	85.92	92.46	-29.29	81.93	84.31	4063.70	3827.20
97	Rajah	LL	75.41	84.29	90.26	-92.56	82.60	82.55	3979.00	3747.00
98	Yzma	LL	96.20	97.37	98.64	74.30	97.11	97.23	4686.70	4418.70
99	Persimm	LL	94.31	96.07	97.47	56.39	96.19	95.79	4617.20	4352.80
100	Mango	LL	77.21	84.33	91.51	-40.08	80.63	82.91	3996.10	3764.00
101	Perseph	LL	87.21	90.79	95.37	9.72	90.77	90.56	4365.20	4115.30

Apêndice 05 – Resultados da análise da variância (ANOVA) dos coeficientes de digestibilidade da matéria seca, proteína, fibra, energia bruta, energia digestível,gordura bruta e energia metabolizável comparando as 3 dietas

Dependent Variable: Drymater

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	179.202246	89.601123	1.32	0.2707
Error	98	6629.730932	67.650316		
Corrected Total	100	6808.933178			

R-Square	Coeff Var	Root MSE	Drymater Mean
0.026319	9.762899	8.224981	84.24733

Dependent Variable: Protein

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	97.847215	48.923608	1.43	0.2435
Error	98	3345.748734	34.140293		
Corrected Total	100	3443.595949			

R-Square	Coeff Var	Root MSE	Protein Mean
0.028414	6.571553	5.842970	88.91307

Dependent Variable: Fiber

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	9629.3494	4814.6747	1.40	0.2513
Error	98	336842.2234	3437.1655		
Corrected Total	100	346471.5727			

R-Square	Coeff Var	Root MSE	Fiber Mean
0.027793	-671.7980	58.62734	-8.726931

Dependent Variable: CHO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	158.502343	79.251171	1.67	0.1943
Error	98	4662.022452	47.571658		
Corrected Total	100	4820.524794			

R-Square	Coeff Var	Root MSE	CHO Mean
0.032881	7.880389	6.897221	87.52386

Dependent Variable: Fat

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	85.949434	42.974717	3.33	0.0398
Error	96	1237.100598	12.886465		
Corrected Total	98	1323.050032			

R-Square	Coeff Var	Root MSE	Fat Mean
0.064963	3.851958	3.589772	93.19343

Dependent Variable: Energy

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	127.537132	63.768566	1.65	0.1976

Error	98	3790.076832	38.674253	
Corrected Total	100	3917.613964		

R-Square	Coeff Var	Root MSE	Energy Mean
0.032555	7.067740	6.218863	87.98941

Dependent Variable: DE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	404050.256	202025.128	2.17	0.1199
Error	98	9134473.774	93208.916		
Corrected Total	100	9538524.029			

R-Square	Coeff Var	Root MSE	DE Mean
0.042360	7.174494	305.3014	4255.371

Dependent Variable: ME

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	386766.872	193383.436	2.25	0.1106
Error	97	8326679.630	85842.058		
Corrected Total	99	8713446.502			

R-Square	Coeff Var	Root MSE	ME Mean
0.044387	7.307894	292.9882	4009.201

Apêndice 06 – Resultados da análise da variância (ANOVA) dos coeficientes de digestibilidade da matéria seca, proteína, fibra, energia bruta, energia digestível,gordura bruta e energia metabolizável comparando as 2 dietas (HL ou LMCT e LL ou HMCT)

Dependent Variable: Drymater

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	8.074274	8.074274	0.11	0.7358
Error	63	4429.530702	70.310011		
Corrected Total	64	4437.604975			

R-Square	Coeff Var	Root MSE	Drymater Mean
0.001820	10.06874	8.385107	83.27862

Dependent Variable: Protein

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2.544065	2.544065	0.07	0.7924
Error	63	2293.469833	36.404283		
Corrected Total	64	2296.013898			

R-Square	Coeff Var	Root MSE	Protein Mean
0.001108	6.841576	6.033596	88.19015

Dependent Variable: Fat

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	16.2566339	16.2566339	1.06	0.3067
Error	63	964.3764215	15.3075622		
Corrected Total	64	980.6330554			

R-Square	Coeff Var	Root MSE	Fat Mean
0.016578	4.225760	3.912488	92.58662

Dependent Variable: Fiber

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1487.8539	1487.8539	0.44	0.5113
Error	63	214839.7826	3410.1553		
Corrected Total	64	216327.6366			

R-Square	Coeff Var	Root MSE	Fiber Mean
0.006878	-378.9863	58.39653	-15.40862

Dependent Variable: CHO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	7.126406	7.126406	0.14	0.7126
Error	63	3277.950896	52.030967		
Corrected Total	64	3285.077302			

R-Square	Coeff Var	Root MSE	CHO Mean
0.002169	8.328159	7.213249	86.61277

Dependent Variable: Energy

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1.109112	1.109112	0.03	0.8697
Error	63	2573.889910	40.855395		
Corrected Total	64	2574.999022			

R-Square	Coeff Var	Root MSE	Energy Mean
0.000431	7.333708	6.391823	87.15677

Dependent Variable: DE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	16.163	16.163	0.00	0.9899
Error	63	6273276.426	99575.816		
Corrected Total	64	6273292.590			

R-Square	Coeff Var	Root MSE	DE Mean
0.000003	7.498426	315.5564	4208.301

Dependent Variable: ME

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	358.555	358.555	0.00	0.9506
Error	62	5755110.900	92824.369		
Corrected Total	63	5755469.455			

R-Square	Coeff Var	Root MSE	ME Mean
0.000062	7.688701	304.6709	3962.580

Apêndice 07 – Resultados da análise de triglicerídeos (Trig), colesterol total (Ch) e frações do colesterol (Beta, P-Beta e Alfa)

Name	Diet	Time	Beta	P-Beta	Alpha	Ch	Trig
Apple	GLA	0	7,80	13,53	105,19	126,53	21,89
Apricot	GLA	0	5,37	16,65	90,97	112,98	24,89
Chevelle	GLA	0	8,42	17,57	60,94	86,93	34,72
Ferrari	GLA	0	17,24	38,24	90,44	145,91	27,84
Kiwi	GLA	0	16,64	39,75	90,19	146,58	41,80
Lavender	GLA	0	12,02	26,50	65,35	103,88	29,73
Lynx	GLA	0	28,51	34,93	101,71	165,16	20,85
Marigold	GLA	0	12,46	16,57	68,57	97,59	26,26
Mulan	GLA	0	6,89	7,92	63,47	78,28	13,03
Mystique	GLA	0	19,42	20,35	63,56	103,33	17,31
Apple	GLA	14	14,05	23,48	67,09	104,63	19,30
Apricot	GLA	14	30,64	43,33	117,71	191,67	27,88
Chevelle	GLA	14	19,34	28,61	63,99	111,95	18,94
Ferrari	GLA	14	24,41	40,75	97,90	163,07	31,50
Kiwi	GLA	14	22,88	44,67	92,87	160,42	48,04
Lavender	GLA	14	22,98	32,15	95,70	150,85	40,81
Lynx	GLA	14	29,66	45,33	109,63	184,63	19,41
Marigold	GLA	14	24,90	40,84	99,67	165,42	20,23
Mulan	GLA	14	20,54	25,67	78,38	124,59	20,03
Mystique	GLA	14	17,46	37,44	65,37	120,26	18,63
Apple	GLA	28	12,83	21,16	118,97	152,97	20,44
Apricot	GLA	28	34,45	63,50	180,40	278,35	25,58
Chevelle	GLA	28	13,08	19,35	101,42	133,84	15,46
Ferrari	GLA	28	17,87	24,71	153,28	195,86	25,68
Kiwi	GLA	28	27,16	63,39	139,63	230,18	38,05
Lavender	GLA	28	30,18	48,86	132,15	211,20	42,77
Lynx	GLA	28	30,23	20,28	194,77	245,28	20,86
Marigold	GLA	28	26,33	18,73	170,68	215,75	23,59
Mulan	GLA	28	21,60	20,47	93,98	136,04	21,49
Mystique	GLA	28	24,68	25,70	101,34	151,72	22,38
Apple	GLA	56	20,64	31,89	81,33	133,86	19,90
Apricot	GLA	56	38,32	44,64	150,65	233,61	22,63
Chevelle	GLA	56	13,45	17,91	79,59	110,95	11,92
Ferrari	GLA	56	32,02	15,16	136,76	183,95	22,63
Kiwi	GLA	56	20,73	29,69	131,21	181,64	32,12
Lavender	GLA	56	21,86	32,28	118,82	172,95	42,93
Lynx	GLA	56	41,39	23,56	193,12	258,06	15,25
Marigold	GLA	56	22,86	15,73	157,16	195,75	22,12
Mulan	GLA	56	17,82	11,98	91,87	121,67	18,28
Mystique	GLA	56	16,59	16,48	106,14	139,22	16,01
Aphrodite	HL	0	5,71	14,93	91,23	111,87	19,08
Artemis	HL	0	7,75	13,72	94,18	115,65	24,59
Aurora	HL	0	6,91	18,67	60,91	86,49	14,21
Ginger	HL	0	13,25	29,86	76,00	119,13	22,23
Jasmine	HL	0	41,33	62,84	132,47	236,64	32,16

Name	Diet	Time	Beta	P-Beta	Alpha	Ch	Trig
Lilac	HL	0	14,45	40,09	56,81	111,35	29,11
Mimosa	HL	0	12,87	18,57	72,74	104,18	25,08
Nala	HL	0	6,06	13,56	91,82	111,43	21,74
Tulip	HL	0	15,35	19,29	61,76	96,41	24,79
Zephyr	HL	0	16,79	24,02	53,85	94,67	19,23
Aphrodite	HL	14	18,35	27,64	97,86	143,83	15,53
Artemis	HL	14	19,61	29,54	81,95	131,10	13,67
Aurora	HL	14	23,01	30,21	78,67	131,88	18,01
Ginger	HL	14	26,66	33,12	92,64	152,41	18,48
Jasmine	HL	14	43,51	42,11	155,99	241,71	32,43
Lilac	HL	14	24,85	29,45	82,83	137,12	15,89
Mimosa	HL	14	27,33	32,11	92,91	152,35	18,48
Nala	HL	14	26,83	35,06	98,40	160,30	24,37
Tulip	HL	14	17,01	39,03	63,19	119,23	28,19
Zephyr	HL	14	30,91	40,67	96,56	168,13	16,61
Aphrodite	HL	28	34,10	36,24	125,75	196,09	31,13
Artemis	HL	28	29,24	41,13	103,71	174,08	22,12
Aurora	HL	28	23,64	17,99	138,75	180,38	16,35
Ginger	HL	28	23,24	22,40	152,97	198,60	19,71
Jasmine	HL	28	44,98	85,68	199,59	330,23	27,25
Lilac	HL	28	11,53	22,43	133,22	167,17	20,76
Mimosa	HL	28	32,91	18,43	122,80	174,15	18,97
Nala	HL	28	40,85	36,16	158,03	235,03	19,18
Tulip	HL	28	15,11	18,89	88,67	122,68	26,21
Zephyr	HL	28	37,51	22,84	108,79	169,14	21,59
Aphrodite	HL	56	31,22	42,11	101,72	175,05	23,74
Artemis	HL	56	27,32	47,35	92,47	167,13	23,43
Aurora	HL	56	19,09	14,84	116,43	150,36	15,56
Ginger	HL	56	30,97	22,46	126,79	180,23	17,58
Jasmine	HL	56	31,70	18,85	119,67	170,22	21,41
Lilac	HL	56	19,39	15,38	117,79	152,56	15,71
Mimosa	HL	56	23,53	14,28	122,00	159,81	16,36
Nala	HL	56	25,41	16,44	174,89	216,73	17,27
Tulip	HL	56	12,36	16,55	78,41	107,31	24,44
Zephyr	HL	56	32,23	21,95	156,29	210,46	17,22
Zephyr	HL	140	34,75	11,78	138,54	185,06	11,075
Athena	LL	0	5,74	20,09	100,03	125,86	40,23
Guava	LL	0	6,07	13,43	75,13	94,63	21,59
Hera	LL	0	10,09	20,64	59,28	90,00	22,13
Mango	LL	0	18,43	33,23	58,37	110,02	29,31
Persephone	LL	0	12,74	25,65	100,71	139,11	18,35
Persimmon	LL	0	11,39	22,77	56,11	90,26	15,74
Rajah	LL	0	7,29	17,51	112,38	137,18	23,80
Verbena	LL	0	20,59	44,57	62,33	127,49	21,64
Yzma	LL	0	33,10	38,42	116,05	187,58	24,39
Athena	LL	14	24,12	32,43	88,53	143,65	35,43
Guava	LL	14	19,50	30,92	68,93	119,35	24,06
Hera	LL	14	21,34	35,40	79,95	136,70	20,34
Mango	LL	14	23,18	38,88	84,80	146,87	14,75
Persephone	LL	14	27,08	31,13	105,10	163,31	23,44
Persimmon	LL	14	19,17	20,05	58,81	98,04	19,82
Rajah	LL	14	31,38	51,19	110,18	192,75	37,08
Verbena	LL	14	25,17	39,93	82,99	148,08	48,25

Name	Diet	Time	Beta	P-Beta	Alpha	Ch	Trig
Yzma	LL	14	25,49	56,12	124,91	206,51	38,64
Athena	LL	28	29,90	48,20	117,70	195,79	30,50
Guava	LL	28	23,95	44,91	80,40	149,25	32,60
Hera	LL	28	14,60	41,11	130,28	185,99	38,05
Mango	LL	28	24,85	29,68	151,59	206,11	50,00
Persephone	LL	28	37,55	29,79	175,25	242,59	18,55
Persimmon	LL	28	14,97	28,28	75,10	118,35	17,82
Rajah	LL	28	25,32	38,57	189,14	253,03	24,84
Verbena	LL	28	25,44	44,54	170,83	240,81	40,57
Yzma	LL	28	47,80	33,34	177,51	258,65	19,55
Athena	LL	56	27,51	47,40	92,14	167,06	30,91
Guava	LL	56	16,05	22,15	48,16	86,36	21,47
Hera	LL	56	19,22	15,96	106,11	141,28	16,44
Mango	LL	56	31,11	29,38	150,64	211,13	22,22
Persephone	LL	56	24,34	13,53	126,88	164,75	14,65
Persimmon	LL	56	13,50	10,86	64,95	89,31	21,77
Rajah	LL	56	27,80	28,24	168,55	224,58	29,60
Verbena	LL	56	30,88	24,32	146,75	201,95	22,42
Yzma	LL	56	27,46	19,61	182,41	229,48	22,98

Apêndice 08 - Resultados da análise da variância (ANOVA - Médias repetidas no tempo) dos Triglicerídeos plasmáticos, colesterol total e suas frações: beta, pre beta e alfa comparando 2 dietas (HL ou LMCT e LL ou HMCT)

Alfa

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.06	0.8169
Time	3	17	22.24	<.0001
Diet*Time	3	17	1.57	0.2330

Pre-beta

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	2.78	0.1137
Time	3	17	10.73	0.0003
Diet*Time	3	17	3.61	0.0348

Triglicerideos plasmáticos

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	6.20	0.0234
Time	3	17	4.60	0.0156
Diet*Time	3	17	2.32	0.1121

Colesterol Total

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.08	0.7813
Time	3	17	60.51	<.0001
Diet*Time	3	17	1.81	0.1844

Beta

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	1	17	0.16	0.6956
Time	3	50	17.92	<.0001
Diet*Time	3	50	0.07	0.9744

Apêndice 09 – Resultados da análise da variância (ANOVA – Médias repetidas no tempo) dos Triglicerídeos plasmáticos, colesterol total e suas frações: beta, pre-beta e alfa comparando 3 dietas.

Beta

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.38	0.6860
Time	3	26	20.63	<.0001
Diet*Time	6	26	0.44	0.8445

Pre-beta

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.71	0.5001
Time	3	26	21.55	<.0001
Diet*Time	6	26	1.05	0.4161

Alfa

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.03	0.9740
Time	3	26	43.13	<.0001
Diet*Time	6	26	0.86	0.5349

Colesterol Total

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	0.04	0.9586

Time	3	26	54.97	<.0001
Diet*Time	6	26	1.08	0.4002

Triglicerídeos

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Diet	2	26	1.48	0.2452
Time	3	75	2.97	0.0372
Diet*Time	6	75	0.61	0.7182

Apêndice 10 - Perfil de ácidos graxos dos fosfolipideos plasmáticos (% do total de lipídeos)

CAT	TIME	DIET	10:00	12:00	14:00	15:00	16:00	16:01	17:00	17:01	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:0	20:1	20:2
Apple	0	GLA	0,00	0,39	0,31	0,13	13,28	0,35	0,76	0,00	28,12	12,66	1,94	25,31	0,00	0,44	1,00	0,40	0,62
Apricot	0	GLA	0,00	0,00	0,79	0,23	22,10	0,55	0,81	0,00	28,02	9,73	1,09	16,55	0,35	0,00	1,29	0,45	0,71
Chevel	0	GLA	0,00	0,00	0,23	0,00	13,63	0,40	0,69	0,00	25,49	11,42	2,57	27,87	0,00	0,36	0,85	0,34	0,62
Ferrari	0	GLA	0,00	0,00	0,19	0,14	14,14	0,32	0,69	0,00	29,45	9,90	2,00	25,72	0,34	0,26	0,77	0,30	0,47
Kiwi	0	GLA	0,00	0,00	0,28	0,19	13,09	0,46	0,68	0,00	28,70	11,61	2,65	26,11	0,41	0,00	0,80	0,48	0,86
Lynx	0	GLA	0,00	0,00	0,21	0,22	11,99	0,42	0,63	0,00	28,71	11,14	3,15	21,36	0,00	0,00	1,24	0,47	0,75
Marigol	0	GLA	0,00	0,00	0,22	0,16	13,15	0,53	0,75	0,34	28,10	11,43	2,62	24,94	0,40	0,34	0,81	0,53	0,84
Mulan	0	GLA	0,00	0,00	0,15	0,14	13,79	0,25	0,74	0,20	28,79	11,72	2,65	24,76	0,34	0,28	0,74	0,37	0,82
Lavende	0	GLA	0,00	0,00	0,18	0,21	14,95	0,38	0,82	0,00	32,36	9,58	2,87	21,53	0,51	0,33	1,41	0,47	0,52
Mystiq	0	GLA	0,00	0,00	0,12	0,11	12,63	0,23	0,59	0,00	32,47	8,92	1,83	24,26	0,30	0,24	0,66	0,34	0,40
Apple	14	GLA	0,00	0,00	0,78	0,08	16,28	0,77	0,39	0,14	27,70	8,79	2,01	21,26	1,32	0,31	0,86	0,80	0,45
Apricot	14	GLA	0,00	0,00	0,69	0,10	15,83	0,72	0,36	0,00	27,54	9,04	2,02	22,36	1,15	0,35	0,74	0,41	0,49
Chevel	14	GLA	0,00	0,00	0,93	0,36	14,75	0,61	1,33	0,00	25,98	8,45	2,83	20,41	1,01	0,37	0,78	0,52	0,59
Ferrari	14	GLA	0,00	0,00	0,06	0,00	8,42	0,34	0,13	0,00	31,78	9,27	2,88	26,84	0,72	0,23	0,59	0,10	0,27
Kiwi	14	GLA	0,00	0,09	0,70	0,12	14,99	0,61	0,15	0,00	30,72	8,23	2,08	20,59	0,61	0,34	1,03	0,30	0,59
Lynx	14	GLA	0,00	0,00	0,49	0,10	14,82	0,60	0,36	0,09	26,97	9,08	3,24	24,00	0,72	0,37	0,63	0,20	0,51
Marigol	14	GLA	0,00	0,00	0,43	0,11	14,05	0,74	0,42	0,00	28,57	9,10	1,91	23,22	0,69	0,30	0,80	0,31	0,60
Mulan	14	GLA	0,00	0,00	0,53	0,18	15,83	0,60	0,44	0,15	26,25	9,79	2,11	24,21	0,78	0,46	0,67	0,34	0,61
Lavende	14	GLA	0,00	0,00	0,46	0,14	14,65	0,59	0,36	0,15	29,51	7,96	1,68	24,12	0,74	0,19	0,57	0,16	0,42
Mystiq	14	GLA	0,00	0,00	0,43	0,00	13,50	0,51	0,39	0,00	28,97	8,96	1,71	24,58	0,52	0,00	0,62	0,63	0,48
Apple	28	GLA	0,00	0,11	0,70	0,12	17,72	0,51	0,34	0,21	29,43	9,48	1,91	21,54	0,84	0,27	0,71	0,14	0,37
Apricot	28	GLA	0,00	0,00	0,69	0,00	14,55	0,66	0,30	0,00	26,92	9,49	1,65	20,62	0,88	0,34	0,61	0,25	0,50
Chevel	28	GLA	0,00	0,00	0,59	0,18	15,79	0,45	0,38	0,00	29,88	8,75	2,45	19,55	0,52	0,32	0,70	0,28	0,56
Ferrari	28	GLA	0,00	0,00	0,42	0,16	14,89	0,39	0,36	0,00	30,14	7,86	1,63	20,84	0,48	0,25	0,67	0,21	0,44
Kiwi	28	GLA	0,00	0,07	0,57	0,15	14,26	0,61	0,40	0,00	25,93	8,88	2,08	22,64	0,56	0,31	0,81	0,63	0,63
Lynx	28	GLA	0,00	0,00	0,65	0,00	14,27	0,62	0,38	0,00	27,95	8,24	1,85	22,50	0,63	0,34	0,64	0,46	0,65
Marigol	28	GLA	0,00	0,00	0,43	0,00	13,79	0,65	0,45	0,00	30,35	9,54	2,29	18,92	0,57	0,34	0,93	0,29	0,58
Mulan	28	GLA	0,00	0,04	0,32	0,10	13,42	0,35	0,44	0,23	30,16	9,28	2,62	16,35	0,44	0,36	0,94	0,47	0,80
Lavende	28	GLA	0,00	0,07	0,37	0,00	13,48	0,48	0,32	0,00	29,79	7,59	1,42	22,84	0,84	0,24	0,72	0,24	0,47
Mystiq	28	GLA	0,00	0,08	0,47	0,10	14,70	0,56	0,40	0,00	32,34	9,21	2,25	18,99	0,90	0,25	0,82	0,25	0,47
Apple	56	GLA	0,00	0,00	0,26	0,06	11,77	0,37	0,30	0,00	28,86	9,24	1,44	21,99	0,83	0,35	0,99	0,21	0,53
Apricot	56	GLA	0,00	0,08	0,65	0,10	14,55	0,67	0,15	0,00	27,73	9,36	1,64	20,30	0,75	0,38	0,76	0,25	0,57
Chevel	56	GLA	0,00	0,00	0,36	0,00	12,31	0,39	0,37	0,00	28,44	8,36	2,16	18,71	0,49	0,44	1,12	0,61	0,68
Ferrari	56	GLA	0,00	0,00	0,16	0,00	8,00	0,20	0,25	0,00	27,47	6,91	1,38	19,43	0,44	0,27	1,02	0,30	0,64
Kiwi	56	GLA	0,00	0,07	0,53	0,13	13,47	0,57	0,19	0,00	28,19	8,46	1,99	22,37	0,42	0,31	0,76	0,34	0,66
Lynx	56	GLA	0,00	0,00	0,46	0,00	14,08	0,52	0,00	0,00	26,37	9,67	2,37	23,04	0,64	0,34	0,92	0,33	0,61
Marigol	56	GLA	0,00	0,00	0,35	0,25	12,79	0,44	0,40	0,00	28,32	8,38	1,65	19,65	0,50	0,28	0,86	0,23	0,60
Mulan	56	GLA	0,00	0,00	0,29	0,00	12,17	0,38	0,41	0,00	26,57	8,87	2,27	20,22	0,46	0,39	0,93	0,45	0,84

CAT	TIME	DIET	10:00	12:00	14:00	15:00	16:00	16:01	17:00	17:01	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:0	20:1	20:2
Lavende	56	GLA	0,00	0,00	0,37	0,00	13,93	0,50	0,20	0,00	32,02	7,27	1,52	21,58	0,63	0,00	0,93	0,35	0,40
Mystiq	56	GLA	0,00	0,00	0,47	0,00	13,18	0,56	0,34	0,00	29,79	8,65	1,58	22,88	0,62	0,24	0,71	0,22	0,50
Aphrod	0	HL	0,00	0,00	0,20	0,00	13,63	0,73	1,39	0,00	23,72	16,20	3,46	22,54	0,00	0,54	0,95	0,61	1,31
Artemis	0	HL	0,00	0,03	0,14	0,13	12,97	0,30	0,72	0,00	29,51	9,92	2,09	25,87	0,41	0,27	0,89	0,37	0,72
Aurora	0	HL	0,00	0,00	0,11	0,18	10,78	0,34	0,81	0,00	28,70	10,99	2,37	23,95	0,00	0,38	1,01	0,42	0,95
Ginger	0	HL	0,00	0,00	0,20	0,00	13,52	0,36	0,71	0,00	28,24	11,13	2,37	26,62	0,41	0,29	0,87	0,45	0,64
Jasmine	0	HL	0,00	0,00	0,00	0,00	10,51	0,34	0,52	0,00	27,28	11,64	1,91	29,03	0,00	0,26	0,58	0,27	0,56
Lilac	0	HL	0,00	0,00	0,35	0,00	14,48	0,41	0,83	0,00	30,84	11,06	2,42	24,85	0,00	0,00	1,20	0,66	0,55
Mimosa	0	HL	0,00	0,00	0,16	0,13	13,51	0,32	0,69	0,23	29,04	10,96	2,16	28,92	0,29	0,30	0,61	0,30	0,54
Nala	0	HL	0,00	0,00	0,10	0,00	10,98	0,30	0,48	0,00	30,55	9,27	1,87	25,22	0,00	0,16	0,70	0,31	0,57
Tulip	0	HL	0,00	0,00	0,15	0,16	14,05	0,39	0,71	0,27	27,85	10,80	1,46	26,25	0,35	0,37	0,72	0,38	0,72
Zephyr	0	HL	0,06	0,00	0,22	0,22	16,06	0,35	0,83	0,00	30,42	10,97	3,04	23,03	0,44	0,33	1,30	0,42	0,67
Aphrod	14	HL	0,00	0,00	0,42	0,00	14,63	0,53	0,00	0,00	22,67	8,75	2,80	33,31	0,00	0,17	1,16	0,73	1,82
Artemis	14	HL	0,00	0,00	0,24	0,10	12,19	0,38	0,07	0,00	27,42	7,06	2,06	34,22	0,00	0,24	1,11	0,51	1,36
Aurora	14	HL	0,00	0,00	0,45	0,15	14,12	0,46	0,00	0,00	27,23	8,57	2,07	33,08	0,00	0,27	0,89	0,39	1,13
Ginger	14	HL	0,00	0,00	0,54	0,14	14,85	0,58	0,42	0,00	25,41	9,06	2,03	30,52	0,00	0,32	0,96	0,32	0,81
Jasmine	14	HL	0,00	0,00	0,39	0,12	14,94	0,45	0,38	0,00	25,70	8,51	1,86	34,02	0,00	0,51	0,87	0,48	0,70
Lilac	14	HL	0,00	0,00	0,42	0,12	16,28	0,74	0,45	0,17	30,44	7,60	2,68	29,64	0,00	0,14	0,63	0,37	0,69
Mimosa	14	HL	0,00	0,00	0,31	0,00	14,92	0,41	0,43	0,00	28,01	7,78	1,99	33,74	0,00	0,00	0,94	0,31	0,72
Nala	14	HL	0,00	0,00	0,21	0,11	14,68	0,43	0,41	0,00	30,22	8,01	1,99	32,78	0,00	0,19	0,73	0,31	0,64
Tulip	14	HL	0,00	0,00	0,42	0,19	16,48	0,57	0,45	0,11	28,30	7,75	2,33	31,31	0,00	0,21	0,98	0,33	0,97
Zephyr	14	HL	0,00	0,00	0,28	0,13	15,05	0,40	0,11	0,00	26,72	7,93	2,85	30,85	0,00	0,24	1,49	0,52	1,03
Aphrod	28	HL	0,00	0,00	0,49	0,24	16,17	0,65	0,51	0,00	22,33	8,69	2,49	38,11	0,00	0,27	0,82	0,57	1,47
Artemis	28	HL	0,00	0,00	0,36	0,20	14,16	0,43	0,42	0,00	27,24	7,23	1,85	35,91	0,00	0,27	0,85	0,37	1,07
Aurora	28	HL	0,00	0,00	0,35	0,13	14,14	0,44	0,41	0,18	25,39	7,88	2,18	37,56	0,00	0,27	0,87	0,47	1,22
Ginger	28	HL	0,00	0,00	0,34	0,16	14,81	0,53	0,43	0,21	25,44	8,37	2,16	35,50	0,00	0,23	0,85	0,39	0,87
Jasmine	28	HL	0,00	0,04	0,36	0,10	14,54	0,45	0,41	0,00	26,02	7,83	1,61	34,55	0,00	0,26	0,83	0,43	0,83
Lilac	28	HL	0,00	0,00	0,40	0,13	14,45	0,60	0,48	0,00	27,15	8,00	2,34	32,66	0,00	0,27	0,83	0,48	0,95
Mimosa	28	HL	0,00	0,00	0,18	0,00	14,25	0,34	0,17	0,00	27,18	7,44	1,98	35,82	0,00	0,28	0,87	0,40	0,85
Nala	28	HL	0,00	0,00	0,14	0,19	12,97	0,29	0,41	0,00	32,60	8,18	2,16	24,18	0,00	0,27	0,88	0,36	0,66
Tulip	28	HL	0,00	0,00	0,28	0,00	13,16	0,39	0,44	0,00	30,17	7,64	2,42	26,03	0,00	0,23	1,05	0,48	1,23
Zephyr	28	HL	0,00	0,00	0,39	0,16	17,45	0,49	0,21	0,00	30,24	6,57	3,76	24,95	0,00	0,49	1,98	0,72	1,53
Aphrod	56	HL	0,00	0,00	0,59	0,19	19,20	0,70	0,40	0,00	27,64	8,59	3,10	27,60	0,00	0,29	1,45	0,51	1,25
Artemis	56	HL	0,00	0,00	0,13	0,07	10,08	0,32	0,38	0,00	28,31	7,53	2,02	33,41	0,00	0,27	1,28	0,55	1,52
Aurora	56	HL	0,00	0,00	0,22	0,08	11,62	0,35	0,40	0,00	26,13	7,80	2,10	35,50	0,00	0,23	1,17	0,53	1,51
Ginger	56	HL	0,00	0,09	0,58	0,00	15,02	0,61	0,23	0,00	25,15	9,67	2,07	33,38	0,16	0,28	0,98	0,42	0,91
Jasmine	56	HL	0,00	0,00	0,36	0,12	14,72	0,50	0,13	0,00	26,20	8,72	1,65	34,52	0,00	0,26	0,94	0,42	0,94
Lilac	56	HL	0,00	0,00	0,39	0,00	14,32	0,60	0,00	0,00	26,80	8,84	2,32	33,71	0,00	0,32	0,99	0,44	0,88
Mimosa	56	HL	0,00	0,00	0,19	0,10	11,47	0,30	0,39	0,00	26,83	7,74	1,97	34,56	0,00	0,23	1,08	0,41	1,07

CAT	TIME	DIET	10:00	12:00	14:00	15:00	16:00	16:01	17:00	17:01	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:0	20:1	20:2
Nala	56	HL	0,00	0,00	0,19	0,00	10,91	0,31	0,36	0,00	29,04	7,84	1,66	33,21	0,00	0,18	0,79	0,36	1,02
Tulip	56	HL	0,00	0,00	0,41	0,12	13,64	0,43	0,40	0,00	28,55	7,60	1,88	35,08	0,00	0,15	0,93	0,37	1,28
Zephyr	56	HL	0,00	0,00	0,39	0,17	12,89	0,57	0,43	0,28	24,14	8,29	3,28	32,24	0,00	0,26	1,49	0,92	2,02
Athena	0	LL	0,00	0,00	0,22	0,13	13,34	0,50	0,71	0,00	30,05	11,21	2,39	24,32	0,37	0,00	0,91	0,70	0,73
Guava	0	LL	0,00	0,00	0,15	0,18	12,12	0,55	0,67	0,00	24,70	12,16	2,97	25,61	0,00	0,43	1,17	0,50	0,85
Hera	0	LL	0,00	0,00	0,22	0,00	13,30	0,54	0,77	0,00	29,66	11,12	2,27	25,17	0,46	0,27	0,96	0,39	0,59
Persim	0	LL	0,00	0,00	0,11	0,15	10,84	0,43	0,69	0,00	27,14	12,00	2,71	27,90	0,00	0,35	0,97	0,39	0,78
Mango	0	LL	0,00	0,00	0,00	0,00	14,60	0,40	0,66	0,00	26,76	11,14	2,49	27,09	0,00	0,53	0,69	0,61	0,70
Verbena	0	LL	0,04	0,00	0,14	0,13	12,96	0,32	0,62	0,18	32,11	9,29	1,77	26,46	0,35	0,00	0,66	0,39	0,48
Perseph	0	LL	0,00	0,00	0,21	0,15	15,18	0,39	0,70	0,24	27,73	10,27	2,46	24,58	0,36	0,26	0,76	0,29	0,60
Rajah	0	LL	0,00	0,00	0,21	0,00	13,36	0,34	0,64	0,00	31,97	11,18	2,81	21,73	0,00	0,00	1,11	0,35	0,50
Yzma	0	LL	0,00	0,00	0,14	0,12	13,76	0,37	0,69	0,00	26,61	12,22	3,32	27,35	0,31	0,35	0,72	0,34	0,66
Athena	14	LL	0,00	0,00	0,82	0,12	16,16	0,82	0,37	0,00	26,70	9,73	2,29	27,26	0,19	0,23	0,70	0,29	0,66
Guava	14	LL	0,00	0,10	0,61	0,14	16,50	1,14	0,13	0,00	25,59	10,66	2,61	28,05	0,14	0,51	0,94	0,34	0,66
Hera	14	LL	0,00	0,00	0,42	0,13	14,54	0,40	0,38	0,00	27,45	7,92	1,85	31,98	0,26	0,00	0,88	0,30	0,64
Persim	14	LL	0,00	0,00	0,65	0,20	19,46	0,54	0,55	0,00	34,76	5,70	4,99	19,94	0,00	0,17	1,50	0,29	0,51
Mango	14	LL	0,00	0,00	0,85	0,12	17,15	0,84	0,35	0,20	26,23	9,43	3,04	31,03	0,27	0,48	0,55	0,29	0,64
Verbena	14	LL	0,00	0,00	0,66	0,00	15,46	0,78	0,33	0,00	28,13	9,66	4,46	31,68	0,00	0,32	0,46	0,32	0,51
Perseph	14	LL	0,00	0,00	0,47	0,13	15,97	0,78	0,36	0,10	26,20	9,70	2,19	28,26	0,15	0,34	0,68	0,31	0,67
Rajah	14	LL	0,00	0,00	0,72	0,12	15,82	0,69	0,36	0,12	30,00	9,64	1,99	26,17	0,00	0,32	0,76	0,24	0,56
Yzma	14	LL	0,00	0,00	0,58	0,00	14,60	0,60	0,39	0,00	27,30	9,81	1,91	29,61	0,00	0,51	0,72	0,41	0,77
Athena	28	LL	0,00	0,00	1,04	0,00	16,39	0,98	0,29	0,00	25,08	9,94	2,85	29,04	0,00	0,31	0,52	0,29	0,74
Guava	28	LL	0,00	0,00	0,68	0,18	16,34	1,09	0,40	0,00	24,88	10,71	2,57	30,23	0,00	0,51	0,65	0,34	0,70
Hera	28	LL	0,00	0,00	0,61	0,11	15,18	0,61	0,32	0,00	28,01	9,92	1,67	29,01	0,00	0,47	0,68	0,24	0,57
Persim	28	LL	0,00	0,00	0,83	0,19	16,52	1,07	0,39	0,39	28,44	10,52	2,49	25,96	0,00	0,34	0,70	0,32	0,67
Mango	28	LL	0,00	0,00	0,68	0,20	15,56	0,81	0,37	0,00	26,11	9,67	1,92	30,43	0,00	0,41	0,72	0,40	0,78
Verbena	28	LL	0,00	0,09	0,73	0,15	15,53	0,67	0,38	0,00	27,78	10,58	2,04	28,40	0,00	0,42	0,67	0,31	0,66
Perseph	28	LL	0,00	0,00	0,46	0,00	13,17	0,61	0,38	0,00	25,50	9,54	2,22	22,28	0,36	0,45	0,96	0,71	0,80
Rajah	28	LL	0,00	0,14	0,57	0,19	12,96	0,54	0,32	0,00	28,73	9,40	1,55	27,12	0,00	0,36	0,37	0,37	0,70
Yzma	28	LL	0,00	0,00	0,39	0,00	12,95	0,49	0,38	0,00	27,26	8,48	2,01	32,02	0,00	0,37	0,82	0,41	0,83
Athena	56	LL	0,00	0,00	0,36	0,08	11,87	0,54	0,32	0,00	27,22	10,08	1,92	27,61	0,00	0,31	0,83	0,35	0,86
Guava	56	LL	0,00	0,13	0,46	0,14	12,98	0,60	0,36	0,00	24,63	8,01	1,80	37,54	0,00	0,00	0,85	0,37	1,06
Hera	56	LL	0,00	0,06	0,46	0,12	15,76	0,41	0,39	0,00	29,15	8,07	1,65	29,69	0,00	0,23	0,83	0,24	0,56
Persim	56	LL	0,00	0,13	0,59	0,00	14,96	0,62	0,51	0,00	26,08	8,85	2,12	32,92	0,26	0,00	0,98	0,52	0,69
Mango	56	LL	0,00	0,00	0,72	0,00	15,69	0,70	0,34	0,00	26,56	10,24	2,19	28,34	0,00	0,43	0,87	0,41	0,92
Verbena	56	LL	0,00	0,00	0,51	0,10	14,63	0,65	0,00	0,00	28,35	10,48	2,15	28,10	0,00	0,35	0,78	0,37	0,77
Perseph	56	LL	0,00	0,06	0,42	0,00	13,52	0,71	0,33	0,00	26,27	10,37	1,84	27,06	0,00	0,40	0,87	0,30	0,96
Rajah	56	LL	0,00	0,00	0,45	0,00	12,00	0,48	0,31	0,00	28,66	9,56	1,60	28,83	0,00	0,35	0,77	0,27	0,81
Yzma	56	LL	0,00	0,09	0,62	0,10	14,15	0,76	0,35	0,00	27,99	10,24	2,22	28,89	0,00	0,51	0,81	0,35	0,87

Apêndice 10

CAT	20:3D5,11	20:3D8,11	20:4n6	20:5n3	22:0	22:1	22:422:5	22:624:0	24:1	Sat	MUFAS	PUFAS	HUFAS	NI	Total
Apple	0,51	1,34	5,47	0,43	0,97	0,31	1,15	2,04	1,29	45,91	17,07	36,37	8,15	0,66	99
Apricot	0,56	0,85	4,72	0,16	0,70	0,00	1,16	1,76	1,17	55,29	14,93	25,93	6,91	3,86	96
Chevel	0,49	1,34	5,65	0,30	0,55	0,00	1,00	2,06	1,08	42,60	15,81	38,51	7,84	3,08	97
Ferrari	0,56	1,65	7,25	0,41	0,56	0,00	1,01	2,31	0,95	46,63	13,47	39,29	10,29	0,60	99
Kiwi	0,93	1,23	6,61	0,45	0,47	0,00	1,01	1,72	0,74	44,82	15,94	38,71	9,17	0,52	99
Lynx	0,57	1,70	7,19	0,45	1,05	0,00	1,65	3,58	1,88	45,42	17,06	35,88	11,50	1,64	98
Marigol	0,76	2,35	6,42	0,36	0,55	0,00	1,10	1,88	0,87	44,55	16,31	38,59	8,96	0,54	99
Mulan	0,62	1,56	6,57	0,34	0,65	0,00	1,08	1,77	1,20	45,87	16,39	37,29	8,90	0,46	100
Lavende	0,54	1,09	6,53	0,57	0,76	0,00	0,94	1,51	0,82	51,40	14,12	33,38	8,85	1,09	99
Mystiq	0,61	1,21	9,94	0,25	0,56	0,00	1,02	1,95	0,92	47,88	12,24	39,44	12,43	0,44	100
Apple	0,42	5,64	4,50	1,08	0,63	0,21	0,88	2,15	1,00	47,71	13,76	37,03	7,63	1,51	98
Apricot	0,60	6,72	5,06	0,48	0,50	0,06	0,77	1,55	0,86	46,57	13,13	38,74	7,06	1,56	98
Chevel	0,44	7,94	5,67	0,59	0,63	0,13	0,83	1,80	1,10	45,64	13,65	38,76	8,00	1,96	98
Ferrari	0,40	7,31	5,88	0,13	0,34	0,00	0,72	1,37	0,59	41,78	13,18	43,41	7,64	1,63	98
Kiwi	0,63	8,21	4,56	0,11	0,42	0,00	0,41	1,10	0,63	48,81	11,85	36,57	5,60	2,76	97
Lynx	0,55	7,90	5,78	0,00	0,13	0,00	0,76	1,41	0,60	44,00	13,81	41,49	7,45	0,70	99
Marigol	0,66	7,72	6,23	0,00	0,00	0,00	0,47	1,32	0,70	45,09	12,77	40,50	7,30	1,64	98
Mulan	0,52	8,24	4,93	0,12	0,40	0,00	0,68	0,83	0,57	44,75	13,56	40,91	6,09	0,78	99
Lavende	0,61	7,70	6,85	0,11	0,35	0,00	0,73	0,94	0,46	46,38	11,00	42,08	8,29	0,54	99
Mystiq	0,65	6,72	7,52	0,00	0,44	0,00	0,51	1,40	0,75	45,07	12,55	41,64	8,69	0,73	99
Apple	0,39	6,41	4,81	0,00	0,56	0,00	0,83	1,05	0,89	49,68	13,13	36,51	6,69	0,67	99
Apricot	0,61	9,07	5,76	0,00	0,50	0,00	1,09	3,66	0,88	43,56	12,94	42,53	10,51	0,97	99
Chevel	0,39	8,81	5,75	0,00	0,52	0,00	1,07	1,23	1,05	48,04	12,99	38,20	8,05	0,76	99
Ferrari	0,52	8,20	7,20	0,28	0,53	0,00	1,06	1,85	0,91	47,17	11,00	41,11	10,38	0,73	99
Kiwi	0,49	7,77	6,24	0,56	0,68	0,00	1,22	2,60	1,19	42,87	13,39	43,03	10,63	0,70	99
Lynx	0,64	9,99	5,87	0,34	0,39	0,00	1,05	1,29	0,64	44,28	11,82	43,30	8,55	0,60	99
Marigol	0,55	7,91	6,41	0,00	0,76	0,00	1,46	1,63	1,12	46,71	13,90	38,38	9,50	1,01	99
Mulan	0,53	11,24	5,65	0,00	0,73	0,00	1,30	1,59	1,21	46,15	14,15	38,27	8,54	1,44	99
Lavende	0,60	8,84	7,27	0,24	0,61	0,00	1,23	1,58	0,92	46,06	10,66	43,45	9,61	-0,16	100
Mystiq	0,50	6,23	6,09	0,00	0,75	0,00	1,21	1,64	1,22	50,58	13,50	35,36	8,02	0,55	99
Apple	0,54	8,75	6,34	0,15	0,99	0,00	1,59	1,77	1,60	44,40	12,86	41,66	8,67	1,08	99
Apricot	0,67	10,77	5,77	0,11	0,52	0,00	0,49	1,16	0,87	45,27	12,78	40,24	6,81	1,70	98
Chevel	0,46	9,50	6,16	0,00	0,79	0,00	1,54	1,77	2,39	44,55	13,91	38,58	8,31	2,96	97
Ferrari	0,79	12,17	8,81	0,19	1,18	0,00	2,58	3,71	1,57	39,85	10,35	47,26	13,52	2,54	97
Kiwi	0,54	10,60	5,68	0,12	0,41	0,00	0,96	1,07	0,64	44,31	12,00	42,16	7,27	1,52	98
Lynx	0,46	8,56	5,50	0,00	0,65	0,00	1,12	2,08	1,10	43,43	13,99	41,40	7,75	1,18	99
Marigol	0,63	10,45	7,82	0,00	0,72	0,00	1,75	1,78	1,09	44,83	11,81	42,30	10,20	1,06	99
Mulan	0,49	13,03	6,42	0,00	0,73	0,00	1,40	1,63	1,14	42,35	13,12	43,61	8,20	0,92	99

CAT	20:3D5,11	20:3D8,11	20:4n6	20:5n3	22:0	22:1	22:422:5	22:624:0	24:1	Sat	MUFAS	PUFAS	HUFAS	NI	Total
Lavende	0,46	8,51	6,76	0,00	0,00	0,00	0,52	1,35	0,68	48,24	10,32	39,42	7,83	2,01	98
Mystiq	0,58	5,69	7,26	0,00	0,62	0,00	1,10	0,85	0,52	45,55	11,54	39,28	8,78	3,62	96
Aphrod	1,34	0,96	3,61	0,32	0,94	0,00	1,17	2,07	2,43	41,87	23,74	32,81	6,12	1,58	98
Artemis	0,95	1,07	7,00	0,41	0,67	0,00	1,13	2,37	1,11	45,95	13,80	39,30	10,03	0,95	99
Aurora	0,92	1,26	7,73	0,49	0,77	0,00	1,72	2,91	1,47	43,56	15,59	39,11	11,65	1,74	98
Ginger	0,70	0,87	7,03	0,36	0,68	0,00	1,21	1,84	1,07	45,03	15,37	39,13	9,61	0,46	100
Jasmine	1,00	0,93	6,99	0,44	0,80	0,40	1,19	2,49	1,70	40,70	16,25	41,87	10,09	1,17	99
Lilac	0,59	0,84	5,02	0,00	0,75	0,00	1,34	1,97	1,37	49,57	15,92	34,01	7,19	0,49	100
Mimosa	0,51	0,90	6,12	0,39	0,43	0,00	0,87	1,48	0,76	45,16	14,74	39,70	8,26	0,40	100
Nala	0,77	1,11	9,15	0,30	0,63	0,40	1,40	2,93	1,43	44,34	13,58	40,70	12,87	1,38	99
Tulip	0,68	1,04	6,92	0,38	0,55	0,00	0,96	2,16	1,00	44,95	14,30	39,07	9,66	1,67	98
Zephyr	0,47	0,73	5,11	0,35	0,73	0,00	0,95	1,93	1,03	50,77	15,80	33,07	7,41	0,37	100
Aphrod	1,28	1,01	2,77	0,00	0,81	0,00	0,58	1,52	2,33	40,68	15,15	41,48	3,88	2,69	97
Artemis	0,92	1,03	4,60	0,17	0,68	0,00	0,65	1,71	1,20	42,61	11,21	44,10	6,33	2,08	98
Aurora	0,86	1,00	4,14	0,10	0,53	0,36	0,80	1,31	1,01	44,12	12,86	41,96	5,61	1,06	99
Ginger	0,70	0,86	4,63	0,10	0,61	0,06	0,85	1,46	1,10	43,71	13,15	39,47	6,26	3,68	96
Jasmine	0,83	0,78	3,52	0,00	0,48	0,00	0,78	1,19	0,96	43,57	12,26	41,67	4,81	2,51	97
Lilac	0,61	0,96	4,34	0,00	0,42	0,00	0,62	0,81	0,74	49,25	12,31	37,31	5,27	1,14	99
Mimosa	0,50	1,31	4,75	0,00	0,52	0,00	0,50	1,30	1,02	46,00	11,51	41,94	5,68	0,55	99
Nala	0,56	0,83	4,98	0,00	0,37	0,00	0,68	1,05	0,59	47,36	11,33	41,07	6,08	0,24	100
Tulip	0,61	0,81	4,39	0,00	0,43	0,00	0,60	1,23	0,69	47,76	11,79	39,63	5,71	0,81	99
Zephyr	0,50	0,71	3,72	0,00	0,64	0,00	0,51	1,47	1,06	45,22	12,76	38,25	4,92	3,78	96
Aphrod	1,06	0,60	1,46	0,00	0,64	0,00	0,39	1,01	1,78	41,20	14,17	44,37	2,86	0,25	100
Artemis	0,80	0,82	3,79	0,00	0,59	0,00	0,76	1,32	1,00	43,81	10,88	44,73	5,87	0,58	99
Aurora	0,68	0,65	3,17	0,00	0,57	0,00	0,78	1,15	1,02	41,86	12,17	45,48	5,10	0,49	100
Ginger	0,67	0,64	4,00	0,00	0,60	0,00	0,93	1,15	1,20	42,63	12,85	43,98	6,08	0,53	99
Jasmine	0,89	1,00	4,26	0,21	0,64	0,00	0,84	1,41	1,40	43,43	11,73	43,78	6,24	1,06	99
Lilac	0,59	1,45	4,08	0,30	0,57	0,00	0,97	1,24	1,11	44,02	12,54	42,52	6,60	0,92	99
Mimosa	0,51	0,78	4,53	0,00	0,53	0,00	0,47	1,04	1,08	43,82	11,25	43,64	5,40	1,29	99
Nala	0,60	1,25	6,05	0,00	0,89	0,00	1,43	2,19	2,19	48,95	13,18	35,76	8,80	2,11	98
Tulip	0,69	1,79	5,52	0,25	0,87	0,00	1,31	2,56	1,86	46,98	12,79	38,60	8,62	1,63	98
Zephyr	0,49	0,59	2,67	0,00	0,79	0,00	0,59	1,47	1,41	52,18	12,95	31,82	3,77	3,06	97
Aphrod	1,01	0,52	1,29	0,00	0,73	0,00	0,51	0,84	1,79	51,04	14,69	32,47	1,80	1,80	98
Artemis	1,00	0,98	4,32	0,00	0,96	0,00	1,22	2,09	1,95	42,39	12,37	43,62	6,45	1,62	98
Aurora	0,79	0,78	3,76	0,00	0,88	0,00	1,26	1,99	1,87	41,85	12,65	44,49	5,66	1,02	99
Ginger	0,79	0,86	3,67	0,00	0,66	0,00	0,99	1,30	1,19	43,59	13,96	41,46	5,09	0,99	99
Jasmine	0,99	1,24	3,43	0,00	0,00	0,00	0,77	1,15	1,23	43,18	12,52	42,59	4,64	1,70	98
Lilac	0,60	1,32	3,50	0,00	0,64	0,00	0,96	1,31	1,22	44,07	13,43	41,67	4,84	0,84	99
Mimosa	0,58	1,02	5,26	0,00	0,91	0,00	1,37	1,94	1,80	42,40	12,21	44,59	7,13	0,81	99

CAT	20:3D5,11	20:3D8,11	20:4n6	20:5n3	22:0	22:1	22:422:5	22:624:0	24:1	Sat	MUFAS	PUFAS	HUFAS	NI	Total
Nala	0,83	1,18	5,62	0,00	0,78	0,00	1,31	1,79	1,54	42,99	11,70	44,24	7,82	1,07	99
Tulip	0,79	1,01	4,31	0,00	0,60	0,00	0,78	0,43	0,00	44,66	10,29	43,85	5,52	1,21	99
Zephyr	0,84	0,87	3,45	0,00	0,89	0,00	1,13	2,00	1,89	41,73	15,22	41,49	5,25	1,56	98
Athena	0,81	1,32	6,14	0,34	0,72	0,00	1,25	2,11	1,15	46,98	15,95	36,47	8,92	0,59	99
Guava	0,71	1,11	7,50	0,60	0,78	0,00	1,40	3,12	1,52	41,02	17,70	40,08	11,37	1,20	99
Hera	0,67	1,02	6,18	0,50	0,68	0,00	1,19	2,37	1,13	46,49	15,45	37,52	9,34	0,54	99
Persim	0,85	1,11	7,06	0,51	0,00	0,00	1,13	2,10	1,05	40,86	16,58	40,84	9,85	1,72	98
Mango	0,79	0,98	5,73	0,41	0,52	0,27	1,03	2,01	1,04	44,19	15,95	38,32	8,22	1,54	98
Verbena	0,64	1,02	7,42	0,31	0,61	0,00	1,19	2,15	1,11	48,13	13,06	39,16	10,21	-0,35	100
Perseph	0,73	1,01	8,07	0,50	0,59	0,00	1,10	2,17	1,15	46,20	14,79	38,50	10,96	0,51	99
Rajah	0,55	0,92	7,15	0,41	0,74	0,00	1,30	2,25	1,66	49,19	16,34	33,65	9,95	0,82	99
Yzma	0,71	0,90	6,26	0,43	0,53	0,00	0,99	1,63	0,87	43,26	17,11	38,91	8,62	0,71	99
Athena	0,82	1,80	5,41	0,24	0,50	0,12	0,98	1,50	0,99	46,10	14,24	38,38	7,40	1,28	99
Guava	0,68	1,42	4,21	0,25	0,50	0,00	0,58	1,40	0,78	45,20	15,52	37,19	5,74	2,09	98
Hera	0,67	1,33	5,24	0,22	0,55	0,08	0,93	1,69	1,01	45,05	11,56	42,25	7,37	1,14	99
Persim	0,43	0,78	2,78	0,00	0,52	0,00	0,60	1,17	0,77	58,41	12,29	25,59	3,77	3,72	96
Mango	0,70	1,15	4,01	0,00	0,31	0,00	0,54	0,66	0,39	45,89	14,19	39,15	4,88	0,78	99
Verbena	0,40	1,10	3,55	0,00	0,28	0,00	0,55	0,82	0,34	45,81	15,57	38,42	4,42	0,20	100
Perseph	0,81	1,53	6,90	0,29	0,45	0,12	0,81	1,41	0,66	44,72	13,87	40,72	8,96	0,69	99
Rajah	0,74	1,42	5,74	0,19	0,43	0,00	0,73	1,13	0,85	48,79	13,53	36,44	7,21	1,24	99
Yzma	0,96	1,63	5,78	0,19	0,47	0,00	0,45	1,33	0,84	44,76	13,57	40,54	7,07	1,13	99
Athena	0,89	1,78	5,75	0,00	0,43	0,00	0,96	1,21	0,90	43,76	14,96	40,68	7,91	0,61	99
Guava	0,71	1,47	4,42	0,27	0,39	0,00	0,72	1,41	0,69	43,51	15,40	40,45	6,82	0,65	99
Hera	0,77	1,77	5,11	0,24	0,52	0,00	0,94	1,55	0,91	45,44	13,36	40,42	7,84	0,78	99
Persim	0,88	1,64	4,79	0,00	0,40	0,00	0,73	1,10	0,70	47,47	15,50	36,11	6,63	0,92	99
Mango	0,82	1,50	4,64	0,33	0,53	0,00	0,89	1,37	1,11	44,18	13,92	41,17	7,23	0,73	99
Verbena	0,54	1,46	4,90	0,20	0,55	0,00	1,07	1,20	0,89	45,87	14,48	38,87	7,37	0,78	99
Perseph	0,87	1,93	6,41	0,76	0,99	0,00	2,30	1,26	0,72	41,45	13,80	37,43	10,73	7,33	93
Rajah	0,93	1,90	7,09	0,36	0,64	0,00	1,29	1,90	1,34	44,75	13,20	40,83	9,82	1,22	99
Yzma	0,96	1,65	5,73	0,23	0,58	0,00	1,14	1,39	1,06	43,18	12,45	43,53	7,70	0,84	99
Athena	0,91	2,31	6,69	0,17	0,75	0,00	1,58	1,83	1,54	42,40	14,43	41,28	9,28	1,88	98
Guava	0,70	1,46	3,77	0,00	0,48	0,00	0,37	1,71	0,84	41,09	11,62	45,55	4,80	1,73	98
Hera	0,58	1,38	5,17	0,14	0,55	0,00	0,98	1,43	1,01	47,99	11,38	39,51	7,06	1,12	99
Persim	0,74	1,30	4,44	0,00	0,50	0,00	0,78	1,10	0,83	44,45	12,95	41,53	5,61	1,07	99
Mango	0,82	1,76	4,73	0,00	0,59	0,00	1,09	1,37	1,13	45,60	14,67	38,63	6,36	1,11	99
Verbena	0,65	1,85	5,01	0,00	0,56	0,00	1,27	1,35	1,06	45,64	14,71	38,63	6,91	1,02	99
Perseph	1,02	2,03	6,48	0,21	0,80	0,00	1,49	2,28	1,52	43,60	14,74	40,59	9,12	1,08	99
Rajah	0,94	2,07	6,82	0,16	0,72	0,00	1,24	1,74	1,30	43,92	13,21	41,93	8,94	0,94	99
Yzma	0,97	1,98	5,35	0,14	0,62	0,00	1,06	0,68	0,48	45,08	14,05	40,12	6,89	0,75	99

Apêndice 11 - Perfil de ácidos graxos dos fosfolipideos das membranas plasmáticas dos eritrócitos (% do total de lipídeos)

CAT	DIET	TIME	12:00	14:00	15:00	16:00	16:01	17:00	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:00	20:01	20:02
Apple	GLA	0	0,00	0,21	0,00	19,12	0,41	0,57	15,52	8,34	2,51	21,98	0,00	0,00	0,50	0,49	0,76
Apricot	GLA	0	0,00	0,24	0,14	18,92	0,32	0,67	17,00	7,65	2,57	17,42	0,40	0,22	0,70	0,56	0,86
Chevel	GLA	0	0,01	0,20	0,15	18,27	0,28	0,62	15,93	7,60	2,85	18,67	0,09	0,28	0,64	0,57	0,95
Ferrari	GLA	0	0,01	0,15	0,12	17,26	0,26	0,58	14,24	7,81	2,43	21,45	0,04	0,24	0,54	0,65	1,18
Kiwi	GLA	0	0,00	0,26	0,15	19,03	0,44	0,67	17,20	8,46	3,11	18,08	0,00	0,24	0,66	0,53	0,88
Lynx	GLA	0	0,00	0,27	0,16	21,26	0,38	0,67	17,45	7,46	3,87	18,12	0,00	0,28	0,49	0,58	0,71
Marigol	GLA	0	0,00	0,33	0,00	25,08	0,33	0,75	18,36	6,19	4,52	14,54	0,00	0,00	0,84	0,60	0,75
Mulan	GLA	0	0,00	0,28	0,17	23,19	0,14	0,78	16,57	7,22	4,70	16,59	0,00	0,21	0,60	0,45	0,78
Lavend	GLA	0	0,06	0,26	0,14	19,26	0,40	1,24	14,13	7,12	2,69	20,06	0,10	0,30	0,51	0,47	0,78
Apple	GLA	14	0,15	0,66	0,15	20,49	0,43	0,51	14,07	7,05	1,93	18,43	0,54	0,27	0,49	0,47	0,72
Apricot	GLA	14	0,18	0,80	0,13	20,63	0,51	0,51	16,11	7,33	2,03	18,82	0,58	0,26	0,40	0,46	0,70
Chevel	GLA	14	0,20	0,76	0,13	20,46	0,59	0,54	15,13	7,02	2,55	18,55	0,46	0,27	0,38	0,47	0,76
Ferrari	GLA	14	0,13	0,53	0,00	20,98	0,44	0,46	14,04	7,39	2,63	20,89	0,53	0,25	0,41	0,44	0,78
Kiwi	GLA	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lynx	GLA	14	0,00	0,37	0,00	22,92	0,00	0,43	15,23	7,29	4,29	18,08	0,28	0,00	0,63	0,42	0,82
Marigol	GLA	14	0,00	0,73	0,00	29,39	0,00	0,66	18,11	4,63	6,80	12,36	0,00	0,00	0,82	0,00	0,61
Mulan	GLA	14	0,00	0,63	0,00	21,56	0,48	0,55	12,76	7,82	3,16	21,11	0,60	0,29	0,38	0,45	0,81
Lavend	GLA	14	0,00	0,53	0,00	21,90	0,30	0,51	13,80	6,89	2,50	21,80	0,52	0,00	0,41	0,41	0,75
Mystiq	GLA	14	0,00	0,66	0,00	21,30	0,32	0,49	14,68	8,33	2,78	21,80	0,54	0,22	0,42	0,58	0,77
Apple	GLA	28	0,00	0,58	0,00	20,49	0,00	0,35	16,48	7,06	2,58	18,57	0,00	0,53	0,46	0,46	0,72
Apricot	GLA	28	0,10	0,72	0,00	21,13	0,31	0,40	15,87	7,38	2,37	19,08	0,65	0,27	0,45	0,45	0,75
Chevel	GLA	28	0,00	0,77	0,00	21,22	0,29	0,42	16,01	7,00	2,51	19,56	0,55	0,00	0,40	0,46	0,82
Ferrari	GLA	28	0,11	0,58	0,00	21,05	0,23	0,44	16,29	7,22	2,54	19,68	0,49	0,25	0,37	0,42	0,79
Kiwi	GLA	28	0,12	0,47	0,00	20,46	0,31	0,39	15,59	8,06	2,84	22,01	0,57	0,29	0,39	0,43	0,68
Lynx	GLA	28	0,14	0,68	0,00	21,56	0,24	0,45	17,09	7,14	2,87	18,91	0,45	0,00	0,38	0,57	0,88
Marigol	GLA	28	0,12	0,68	0,12	21,44	0,49	0,53	16,51	6,92	2,57	19,43	0,64	0,28	0,36	0,49	0,76
Mulan	GLA	28	0,14	0,73	0,13	22,76	0,32	0,48	15,21	7,31	3,05	19,39	0,69	0,33	0,31	0,41	0,74
Lavend	GLA	28	0,00	0,70	0,00	24,16	0,35	0,46	14,09	6,70	2,27	21,17	0,70	0,22	0,37	0,41	0,67
Mystiq	GLA	28	0,00	0,75	0,00	23,22	0,50	0,44	14,86	7,98	3,15	20,56	0,00	0,73	0,42	0,55	0,67
Apple	GLA	56	0,19	0,75	0,00	19,85	0,34	0,40	17,23	6,11	1,69	15,88	0,60	0,26	0,36	0,39	0,88
Apricot	GLA	56	0,00	0,95	0,00	19,63	0,32	1,79	16,36	7,56	3,49	16,83	1,03	0,31	0,19	0,26	0,38
Chevel	GLA	56	0,00	0,76	0,00	21,48	0,24	1,20	20,57	6,67	2,73	16,89	0,76	0,40	0,31	0,51	0,33
Ferrari	GLA	56	0,17	0,81	0,00	22,79	0,37	0,45	20,86	6,59	2,13	17,87	0,43	0,08	0,29	0,27	0,79
Kiwi	GLA	56	0,17	0,72	0,00	18,51	0,38	0,41	16,19	6,84	1,98	19,27	0,48	0,32	0,37	0,42	0,79
Lynx	GLA	56	0,18	0,73	0,00	19,40	0,34	0,58	18,61	6,07	2,20	16,96	0,47	0,29	0,35	0,45	0,84
Marigol	GLA	56	0,12	0,54	0,00	16,78	0,33	0,45	18,86	5,72	2,07	16,05	0,55	0,32	0,37	0,42	0,78

CAT	DIET	TIME	12:00	14:00	15:00	16:00	16:01	17:00	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:00	20:01	20:02
Mulan	GLA	56	0,21	0,75	0,00	21,23	0,00	0,27	14,56	6,50	1,74	18,33	0,61	0,00	0,00	0,00	0,47
Lavend	GLA	56	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mystiq	GLA	56	0,00	0,00	0,00	20,86	0,30	0,39	19,01	6,39	3,08	15,49	0,47	0,00	0,24	0,27	0,49
Artemis	HL	0	0,02	0,18	0,14	17,89	0,25	0,68	15,83	7,52	2,37	21,11	0,00	0,26	0,51	0,68	1,32
Aurora	HL	0	0,00	0,16	0,14	16,38	0,24	0,63	16,34	7,08	2,25	19,73	0,00	0,24	0,66	0,57	1,10
Ginger	HL	0	0,02	0,20	0,12	17,57	0,26	0,56	16,40	7,20	2,13	18,23	0,06	0,24	0,46	0,49	0,89
Jasmine	HL	0	0,02	0,15	0,12	17,68	0,23	0,64	15,89	7,88	2,08	21,26	0,00	0,24	0,60	0,51	1,04
Lilac	HL	0	0,00	0,25	0,17	23,44	0,44	0,76	17,58	7,98	4,70	20,54	0,00	0,21	0,50	0,29	0,97
Mimosa	HL	0	0,00	0,24	0,17	22,14	0,40	0,76	16,31	7,85	2,76	23,86	0,00	0,25	0,48	0,48	0,78
Nala	HL	0	0,00	0,22	0,16	24,19	0,43	0,73	21,00	7,27	4,24	17,65	0,00	0,00	0,56	0,59	0,54
Tulip	HL	0	0,04	0,25	0,16	20,21	0,38	0,86	17,27	7,04	2,77	20,96	0,09	0,32	0,43	0,68	1,00
Zephyr	HL	0	0,02	0,28	0,19	22,33	0,42	0,73	14,80	8,47	2,88	21,58	0,13	0,27	0,65	0,48	0,90
Artemis	HL	14	0,06	0,40	0,16	19,58	0,41	0,59	14,70	6,75	2,33	24,47	0,00	0,25	0,47	0,59	1,27
Aurora	HL	14	0,15	0,63	0,16	20,45	0,55	2,51	13,98	7,65	3,12	23,62	0,74	0,44	0,57	0,59	1,09
Ginger	HL	14	0,00	0,00	0,00	19,10	0,00	0,28	13,13	8,00	3,51	27,45	0,00	0,00	0,34	0,39	0,90
Jasmine	HL	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilac	HL	14	0,00	0,23	0,00	20,38	0,17	0,49	14,96	7,25	3,37	25,98	0,00	0,00	0,51	0,67	1,26
Mimosa	HL	14	0,00	0,34	0,00	21,16	0,00	0,51	14,83	7,07	2,92	27,53	0,00	0,00	0,48	0,47	1,03
Nala	HL	14	0,07	0,33	0,00	20,45	0,34	0,52	15,37	7,14	2,58	25,11	0,00	0,15	0,40	0,54	0,91
Tulip	HL	14	0,00	0,45	0,00	21,76	0,39	0,56	14,06	6,73	2,67	26,46	0,00	0,18	0,43	0,52	1,18
Zephyr	HL	14	0,00	0,44	0,00	22,24	0,27	0,58	12,87	8,20	2,95	29,33	0,00	0,23	0,49	0,51	1,10
Artemis	HL	28	0,00	0,40	0,00	19,75	0,24	0,45	16,01	6,65	2,71	25,74	0,21	0,24	0,53	0,59	1,46
Aurora	HL	28	0,00	0,36	0,00	20,70	0,33	0,49	15,03	6,61	2,68	27,56	0,00	0,00	0,47	0,51	1,33
Jasmine	HL	28	0,00	0,37	0,00	20,89	0,30	0,49	17,57	7,40	2,50	26,47	0,00	0,00	0,55	0,42	1,09
Lilac	HL	28	0,00	0,34	0,00	20,35	0,36	0,53	16,86	6,78	2,78	27,48	0,00	0,16	0,32	0,67	1,37
Mimosa	HL	28	0,05	0,35	0,00	21,42	0,30	0,50	17,18	6,42	2,49	27,26	0,00	0,22	0,40	0,48	1,08
Nala	HL	28	0,00	0,29	0,00	19,91	0,29	0,48	18,73	6,67	2,46	24,67	0,00	0,19	0,30	0,54	1,03
Tulip	HL	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zephyr	HL	28	0,00	0,59	0,00	26,42	0,52	0,55	14,82	7,32	3,95	26,57	0,00	0,00	0,61	0,36	1,06
Artemis	HL	56	0,00	0,32	0,00	18,18	0,23	0,40	20,43	5,79	1,93	27,37	0,00	0,10	0,39	0,46	1,52
Aurora	HL	56	0,00	0,89	0,00	19,13	0,34	4,80	18,23	5,84	7,99	11,86	1,73	0,43	0,42	0,40	1,15
Ginger	HL	56	0,00	0,52	0,00	20,19	0,30	0,73	15,81	6,28	2,64	24,20	0,00	0,32	0,40	0,51	1,42
Jasmine	HL	56	0,10	0,50	0,00	21,33	0,23	0,49	15,01	6,96	1,68	26,85	0,00	0,21	0,37	0,35	0,59
Lilac	HL	56	0,00	0,59	0,00	24,80	0,27	0,82	21,04	6,18	2,67	28,23	0,00	0,00	0,32	0,21	0,68
Mimosa	HL	56	0,00	0,25	0,00	14,27	0,00	0,13	16,52	5,21	1,46	25,24	0,00	0,00	0,48	0,29	1,04
Nala	HL	56	0,06	0,38	0,00	20,19	0,27	0,00	19,66	5,13	3,61	20,35	0,00	0,07	0,76	0,39	1,02
Tulip	HL	56	0,05	0,52	0,00	21,22	0,33	0,46	15,65	5,81	2,16	27,53	0,00	0,25	0,36	0,44	1,37

CAT	DIET	TIME	12:00	14:00	15:00	16:00	16:01	17:00	18:00	18:1n9	18:1n7	18:2n6	18:3n6	18:3n3	20:00	20:01	20:02
Zephyr	HL	56	0,09	0,61	0,00	22,73	0,44	0,49	13,14	7,17	2,50	30,69	0,00	0,29	0,39	0,48	1,46
Athena	LL	0	0,00	0,31	0,17	19,04	0,44	0,89	15,11	8,74	2,92	20,58	0,16	0,29	0,54	0,63	1,09
Guava	LL	0	0,02	0,23	0,15	19,57	0,35	0,66	13,29	8,68	2,87	21,57	0,04	0,31	0,50	0,58	0,95
Hera	LL	0	0,01	0,17	0,12	17,48	0,26	0,61	16,92	8,51	2,30	21,51	0,04	0,28	0,54	0,53	0,91
Persim	LL	0	0,02	0,21	0,15	16,95	0,27	0,61	15,01	7,48	2,49	20,03	0,06	0,27	0,47	0,54	0,97
Mango	LL	0	0,02	0,21	0,14	17,57	0,36	0,60	15,87	8,54	2,71	20,05	0,00	0,31	0,53	0,62	1,10
Verbena	LL	0	0,00	0,20	0,00	21,18	0,14	0,67	17,68	8,05	3,63	17,47	0,00	0,00	0,57	0,69	0,93
Perseph	LL	0	0,00	0,37	0,20	24,52	0,36	0,17	18,19	7,34	4,77	18,55	0,00	0,00	0,63	0,73	0,67
Rajah	LL	0	0,02	0,25	0,13	19,95	0,34	0,69	16,37	8,23	2,79	19,53	0,09	0,26	0,44	0,56	0,92
Yzma	LL	0	0,02	0,26	0,15	19,40	0,35	0,63	14,03	7,67	2,66	19,60	0,11	0,30	0,46	0,68	1,06
Athena	LL	14	0,23	1,00	0,16	20,51	0,78	0,52	15,56	8,30	2,74	21,49	0,00	0,26	0,41	0,55	0,96
Guava	LL	14	0,18	0,78	0,15	21,52	0,79	0,53	14,80	7,95	3,19	20,15	0,00	0,30	0,57	0,54	0,79
Hera	LL	14	0,23	0,97	0,17	24,65	0,62	1,79	16,63	7,96	4,77	15,15	0,61	0,34	0,81	0,57	0,73
Persim	LL	14	0,00	0,44	0,00	22,60	0,26	0,39	14,35	7,53	3,77	23,20	0,00	0,00	0,49	0,41	0,77
Mango	LL	14	0,00	0,84	0,00	30,64	0,54	0,00	19,97	6,22	6,02	10,55	0,00	0,00	0,75	0,22	0,60
Verbena	LL	14	0,00	0,48	0,00	18,87	0,00	0,40	12,79	8,23	3,06	21,70	0,00	0,29	1,65	0,60	1,08
Perseph	LL	14	0,00	0,88	0,00	29,30	0,00	0,68	17,55	3,74	7,75	12,94	0,00	0,00	1,04	0,86	0,74
Rajah	LL	14	0,00	0,24	0,00	19,01	0,37	0,32	15,18	8,60	3,05	23,51	0,00	0,00	0,32	0,53	0,72
Yzma	LL	14	0,00	0,88	0,00	23,23	0,30	0,62	14,62	7,44	3,84	20,91	0,00	0,27	0,55	0,66	0,98
Athena	LL	28	0,00	0,83	0,00	20,24	0,56	0,42	15,54	8,19	3,07	23,32	0,00	0,00	0,47	0,57	1,12
Guava	LL	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hera	LL	28	0,16	0,74	0,00	20,40	0,28	0,42	16,44	7,88	2,65	22,20	0,00	0,33	0,47	0,46	0,84
Persim	LL	28	0,19	0,82	0,00	21,06	0,37	0,49	16,41	6,78	3,58	21,04	0,00	0,27	0,52	0,49	0,92
Mango	LL	28	0,25	1,00	0,00	21,55	0,49	0,44	15,83	8,62	2,94	23,57	0,00	0,41	0,35	0,59	1,02
Verbena	LL	28	0,00	0,65	0,00	21,30	0,35	0,45	17,02	8,32	2,88	22,24	0,00	0,43	0,69	0,00	1,06
Perseph	LL	28	0,00	0,71	0,00	22,32	0,36	0,47	15,60	7,25	2,76	23,13	0,00	0,31	0,37	0,64	0,98
Rajah	LL	28	0,00	0,88	0,00	22,32	0,30	0,48	15,41	8,29	2,69	21,70	0,00	0,27	0,37	0,60	0,91
Yzma	LL	28	0,00	1,16	0,00	33,13	0,36	0,68	20,76	5,26	3,38	13,16	0,00	0,00	0,67	0,51	0,61
Athena	LL	56	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Guava	LL	56	0,19	0,71	0,00	18,27	0,40	0,36	17,60	6,91	2,26	18,13	0,00	0,29	0,29	0,41	0,84
Hera	LL	56	0,19	0,84	0,00	20,81	0,31	0,38	18,60	7,50	1,92	19,43	0,00	0,00	0,38	0,40	0,64
Persim	LL	56	0,00	0,75	0,00	19,92	0,33	0,66	17,13	6,84	2,22	22,39	0,00	0,00	0,14	0,00	0,63
Mango	LL	56	0,00	1,20	0,00	24,74	0,58	0,30	16,99	8,30	2,12	24,96	0,00	0,00	0,26	0,42	0,56
Verbena	LL	56	0,00	0,95	0,00	22,96	0,35	0,34	19,18	8,01	2,13	22,53	0,00	0,00	0,00	0,23	0,36
Perseph	LL	56	0,22	0,83	0,00	21,53	0,50	0,42	14,88	6,75	2,44	21,68	0,00	0,35	0,43	0,53	0,87
Rajah	LL	56	0,16	0,81	0,00	20,35	0,37	0,40	16,10	7,53	2,30	21,01	0,00	0,29	0,33	0,49	0,95
Yzma	LL	56	0,24	1,02	0,00	21,09	0,26	0,38	16,43	4,74	5,04	14,63	0,00	0,23	0,36	0,46	1,02

Apêndice 11 -																	
CAT	20:3 D5,11	20:3D8,11	20:4n6	20:5n3	22:00	22:01	22:04	22:05	22:06	20:0	20:1	SAT	MUFA	PUFA	HUFA	NI	Total
Apple	0,95	1,51	13,60	0,35	0,85	0,18	0,95	0,00	0,32	0,00	10,06	36,76	22,00	40,43	15,22	0,82	99
Apricot	1,11	1,58	11,62	0,31	1,05	0,00	1,16	0,32	0,38	0,91	10,09	39,63	21,20	35,39	13,78	3,78	96
Chevel	1,16	1,67	11,68	0,35	0,94	0,18	0,82	0,12	0,42	1,55	10,19	38,31	21,66	36,19	13,39	3,83	96
Ferrari	1,83	0,70	11,90	0,31	0,97	0,28	0,93	0,14	0,36	1,26	10,80	35,13	22,22	39,08	13,64	3,56	96
Kiwi	1,56	1,20	11,04	0,37	1,18	0,34	0,86	0,18	0,39	0,57	9,75	39,73	22,63	34,80	12,84	2,84	97
Lynx	1,09	1,83	12,84	0,32	0,70	0,19	0,85	0,20	0,37	0,33	6,99	41,34	19,47	36,61	14,58	2,59	97
Marigol	0,78	1,46	9,25	0,21	0,97	0,00	0,93	0,00	0,00	1,79	12,31	48,13	23,95	27,92	10,39	0,00	100
Mulan	0,85	1,51	9,46	0,24	0,90	0,25	1,02	0,00	0,22	2,01	11,87	44,49	24,63	30,88	10,94	0,00	100
Lavend	1,22	1,34	11,70	0,40	0,92	0,22	1,09	0,30	0,58	1,21	9,62	37,74	20,52	37,86	14,07	3,88	96
Apple	0,92	2,26	11,69	0,31	0,83	0,21	2,17	0,00	0,25	1,30	10,30	38,65	20,38	37,55	14,41	3,43	97
Apricot	1,18	2,58	12,07	0,21	0,80	0,24	1,06	0,09	0,24	0,77	8,27	40,34	18,84	37,79	13,67	3,04	97
Chevel	1,18	2,93	11,80	0,22	0,79	0,28	0,72	0,11	0,30	1,29	9,36	39,68	20,27	37,30	13,16	2,75	97
Ferrari	1,30	3,17	11,20	0,30	0,78	0,26	1,15	0,24	0,60	1,44	9,24	38,77	20,40	40,39	13,48	0,44	100
Kiwi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lynx	0,91	2,63	9,64	0,00	0,90	0,00	1,00	0,29	0,50	1,61	11,49	42,08	23,50	34,16	11,43	0,26	100
Marigol	0,55	1,53	6,42	0,00	0,99	0,00	0,53	0,00	0,00	2,22	13,64	52,92	25,06	22,02	6,96	0,00	100
Mulan	1,07	3,11	9,99	0,27	0,77	0,13	0,87	0,29	0,23	1,73	10,69	38,38	22,73	38,63	11,65	0,26	100
Lavend	1,18	2,66	10,84	0,00	0,19	0,81	1,13	0,25	0,43	1,53	10,30	38,87	21,20	39,57	12,65	0,36	100
Mystiq	0,90	2,26	10,55	0,00	0,80	0,24	1,35	0,22	0,31	1,26	8,91	39,61	21,15	38,92	12,43	0,32	100
Apple	0,96	3,30	13,38	0,00	0,79	0,24	1,02	0,27	0,00	1,61	10,16	40,75	20,50	38,75	14,67	0,00	100
Apricot	1,20	3,95	12,78	0,00	0,81	0,00	1,55	0,00	0,26	1,42	8,88	40,89	19,40	40,48	14,58	-0,77	101
Chevel	1,16	4,31	12,63	0,48	0,00	0,00	0,90	0,00	0,00	1,56	8,68	40,37	18,94	40,41	14,01	0,27	100
Ferrari	1,30	3,97	12,73	0,65	0,00	0,00	1,43	0,00	0,57	1,24	7,38	40,08	17,78	41,86	15,39	0,27	100
Kiwi	1,43	3,69	11,01	0,19	0,82	0,00	1,13	0,00	0,32	1,18	7,62	39,42	19,27	41,31	12,65	0,00	100
Lynx	1,10	3,70	13,10	0,25	0,57	0,00	1,31	0,00	0,54	1,11	6,98	41,97	17,80	40,23	15,19	0,00	100
Marigol	1,07	3,67	12,26	0,24	0,57	0,14	1,02	0,00	0,21	1,16	7,74	41,49	18,34	39,59	13,74	0,59	99
Mulan	0,99	4,21	11,16	0,15	0,60	0,00	1,08	0,00	0,00	1,39	7,97	41,75	19,07	38,75	12,40	0,43	100
Lavend	1,00	3,54	10,70	0,00	0,71	0,17	1,29	0,00	0,34	1,30	8,43	41,79	18,34	39,64	12,33	0,23	100
Mystiq	0,79	2,96	10,12	0,00	0,80	0,00	1,49	0,00	0,00	1,27	8,77	41,75	20,94	37,31	11,60	0,00	100
Apple	1,21	4,35	14,60	0,09	0,77	0,13	1,04	0,00	0,00	1,66	9,91	41,21	18,57	38,91	15,73	1,31	99
Apricot	0,61	4,79	12,44	0,49	0,76	0,00	1,30	0,00	0,00	1,21	9,13	40,88	20,76	38,18	14,22	0,18	100
Chevel	0,48	3,92	14,10	0,00	0,93	0,00	1,08	0,00	0,00	0,77	5,38	46,03	15,52	37,97	15,18	0,48	100
Ferrari	1,16	4,06	13,60	0,15	0,64	0,12	0,67	0,00	0,10	0,00	3,40	46,02	12,88	38,91	14,52	2,19	98
Kiwi	1,63	4,67	11,66	0,00	0,95	0,21	1,09	0,00	1,80	1,49	9,33	38,82	19,17	41,71	14,55	0,31	100
Lynx	1,27	3,90	14,79	0,00	0,67	0,00	1,11	0,00	0,39	1,24	8,02	41,76	17,08	40,02	16,29	1,14	99
Marigol	1,16	4,95	15,49	0,00	0,75	0,00	1,03	0,00	0,00	1,76	9,96	39,63	18,49	40,34	16,53	1,54	98

CAT	20:3 D5,11	20:3D8,11	20:4n6	20:5n3	22:00	22:01	22:04	22:05	22:06	20:0	20:1	SAT	MUFA	PUFA	HUFA	NI	Total
Mulan	0,67	5,40	12,61	0,00	0,72	0,00	0,85	0,00	0,00	2,02	10,99	39,76	19,24	38,95	13,46	2,05	98
Lavend	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mystiq	0,56	3,81	11,10	0,00	0,97	0,00	1,23	0,00	0,00	1,51	11,32	42,97	21,36	33,17	12,33	2,51	97
Artemis	0,84	0,84	11,38	0,47	0,81	0,25	0,78	0,11	0,41	0,67	9,99	36,72	21,06	37,52	13,15	4,70	95
Aurora	1,48	0,78	11,23	0,53	1,16	0,32	1,10	0,38	0,54	1,23	10,76	36,70	21,21	37,11	13,78	4,98	95
Ginger	1,56	2,04	13,73	0,46	0,88	0,25	1,18	0,14	0,70	0,75	9,60	36,97	19,92	39,21	16,20	3,89	96
Jasmine	1,56	0,81	12,43	0,41	1,15	0,40	1,17	0,12	0,36	0,64	9,49	36,89	20,59	39,38	14,48	3,14	97
Lilac	1,40	0,68	9,63	0,30	0,84	0,23	0,26	0,63	0,19	0,59	6,12	44,14	19,75	34,82	11,02	1,28	99
Mimosa	1,53	0,66	10,92	0,34	0,83	0,22	0,69	0,22	0,23	0,30	6,94	41,24	18,65	39,50	12,41	0,61	99
Nala	0,88	0,55	11,25	0,00	0,91	0,19	0,46	0,24	0,27	0,48	7,14	48,24	19,86	31,84	12,21	0,06	100
Tulip	1,35	0,81	12,10	0,47	0,78	0,21	0,80	0,23	0,49	0,75	6,48	40,75	17,57	38,61	14,08	3,07	97
Zephyr	0,92	0,55	7,66	0,40	0,86	0,40	0,52	0,26	0,30	0,99	7,86	40,85	20,51	33,49	9,14	5,16	95
Artemis	1,56	0,66	9,22	0,26	0,74	0,27	0,57	0,09	0,28	0,96	9,50	37,67	19,86	38,62	10,42	3,85	96
Aurora	1,27	0,74	7,61	0,00	1,02	0,28	0,93	0,00	0,48	0,75	8,57	40,23	20,74	36,93	9,03	2,10	98
Ginger	0,00	1,63	9,47	0,00	0,00	0,00	0,57	0,00	0,00	1,20	12,05	34,06	23,95	40,03	10,04	1,96	98
Jasmine	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilac	1,47	0,67	8,83	0,00	0,76	0,18	0,79	0,23	0,23	1,21	10,17	38,54	21,81	39,48	10,09	0,17	100
Mimosa	1,49	0,62	8,92	0,00	0,82	0,00	0,82	0,00	0,00	1,31	9,68	39,45	20,15	40,41	9,74	0,00	100
Nala	1,02	0,64	10,62	0,00	0,80	0,18	0,64	0,18	0,43	1,49	9,41	39,44	20,19	39,70	11,87	0,67	99
Tulip	1,24	0,73	8,93	0,26	0,72	0,17	0,90	0,21	0,55	1,49	8,88	39,47	19,35	40,63	10,85	0,56	99
Zephyr	1,08	0,60	7,30	0,25	0,74	0,25	0,69	0,20	0,37	1,13	8,19	38,48	20,37	41,15	8,81	0,00	100
Artemis	1,91	1,12	10,32	0,00	0,72	0,00	0,93	0,00	0,00	1,12	8,90	38,97	19,10	41,93	11,25	0,00	100
Aurora	1,86	0,60	8,81	0,00	0,79	0,00	0,77	0,27	0,29	1,48	9,07	39,31	19,19	41,49	10,14	0,00	100
Jasmine	1,64	0,79	10,17	0,00	0,78	0,26	1,06	0,00	0,00	0,99	6,25	41,64	17,15	41,21	11,23	0,00	100
Lilac	1,62	0,68	9,66	0,18	0,52	0,00	0,88	0,00	0,18	0,92	7,09	39,84	17,68	42,19	10,90	0,29	100
Mimosa	1,50	0,60	9,38	0,18	0,62	0,16	0,91	0,00	0,22	1,00	7,01	41,53	16,85	41,37	10,69	0,25	100
Nala	1,31	0,85	12,35	0,19	0,56	0,00	0,81	0,00	0,34	1,06	6,61	41,34	16,57	41,74	13,68	0,36	100
Tulip	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zephyr	0,90	0,47	5,11	0,00	0,74	0,00	0,66	0,00	0,00	1,29	7,73	45,01	19,88	34,77	5,77	0,34	100
Artemis	2,36	0,64	10,63	0,10	0,48	0,00	0,44	0,00	0,00	0,85	7,18	41,06	15,58	43,16	11,16	0,19	100
Aurora	0,88	0,75	4,91	1,13	1,40	0,37	2,50	0,00	0,60	2,39	9,65	47,26	24,58	25,93	9,13	2,23	98
Ginger	2,43	0,56	9,23	0,00	0,92	0,00	0,75	0,00	0,00	1,80	10,32	40,37	20,05	38,92	9,98	0,67	99
Jasmine	1,65	0,37	8,04	0,00	0,91	0,24	0,82	0,00	1,80	1,36	8,59	40,07	18,05	40,33	10,66	1,55	98
Lilac	1,18	0,29	8,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,54	47,56	12,88	38,77	8,40	0,78	99
Mimosa	1,46	0,29	10,73	0,00	1,04	0,00	0,94	0,00	0,00	2,43	17,44	35,11	24,40	39,69	11,67	0,79	99
Nala	1,17	0,54	8,97	0,10	0,91	0,12	0,45	0,00	0,19	1,86	11,59	43,83	21,11	32,88	9,72	2,18	98
Tulip	1,57	0,68	8,62	0,17	0,77	0,14	0,78	0,00	0,40	1,43	9,01	40,46	17,89	41,36	9,97	0,29	100

CAT	20:3 D5,11	20:3D8,11	20:4n6	20:5n3	22:00	22:01	22:04	22:05	22:06	20:0	20:1	SAT	MUFA	PUFA	HUFA	NI	Total
Zephyr	1,28	0,55	5,64	0,00	0,73	0,14	0,55	0,00	0,00	1,19	8,55	39,37	19,28	40,46	6,18	0,90	99
Athena	1,57	0,98	10,43	0,38	0,90	0,26	1,10	0,22	0,45	0,65	8,81	37,60	21,79	37,27	12,58	3,34	97
Guava	1,51	0,77	10,76	0,51	0,77	0,12	0,57	0,11	0,45	1,43	9,76	36,63	22,36	37,54	12,39	3,47	97
Hera	1,35	0,85	11,76	0,53	0,98	0,26	0,91	0,13	0,53	1,25	8,44	38,08	20,29	38,79	13,86	2,84	97
Persim	1,71	1,13	13,87	0,41	0,88	0,26	0,99	0,13	0,44	1,05	9,60	35,34	20,64	40,00	15,84	4,01	96
Mango	1,61	0,89	11,48	0,39	0,86	0,25	1,13	0,12	0,41	0,63	9,73	36,43	22,22	37,49	13,53	3,87	96
Verbena	0,79	0,93	11,26	0,25	0,99	0,21	1,12	0,00	0,36	1,73	10,98	43,03	23,71	33,10	12,99	0,16	100
Perseph	1,15	0,65	11,47	0,42	0,98	0,35	0,77	0,24	0,22	0,00	6,07	45,06	19,63	34,13	13,12	1,18	99
Rajah	1,46	0,79	12,03	0,34	0,99	0,23	0,76	0,25	0,30	0,85	8,26	39,69	20,41	36,74	13,68	3,16	97
Yzma	1,53	0,84	11,42	0,43	0,32	0,16	1,13	0,29	0,35	1,08	9,81	36,34	21,33	37,06	13,60	5,28	95
Athena	1,67	1,01	10,29	0,25	0,77	0,26	0,90	0,10	0,31	0,76	7,65	39,92	20,29	37,24	11,85	2,55	97
Guava	1,45	0,71	9,84	0,35	0,71	0,22	0,42	0,09	0,28	1,52	9,34	40,77	22,03	34,38	10,98	2,82	97
Hera	0,73	0,78	6,35	0,43	1,21	0,33	0,74	0,32	0,39	1,03	9,71	47,49	23,96	26,59	8,24	1,96	98
Persim	1,44	0,90	10,26	0,20	0,84	0,21	0,68	0,00	0,25	1,24	9,53	40,35	21,70	37,71	11,39	0,24	100
Mango	0,55	0,45	4,63	0,00	1,08	0,00	0,53	0,00	0,00	1,79	13,91	55,08	26,89	17,31	5,17	0,72	99
Verbena	0,92	0,99	9,52	0,00	0,94	0,00	0,92	0,00	1,32	2,32	11,04	37,46	22,92	36,73	11,76	2,89	97
Perseph	0,57	0,55	6,22	0,00	1,11	0,37	0,53	0,32	0,00	1,70	12,19	52,26	24,91	21,88	7,07	0,95	99
Rajah	1,26	0,72	10,86	0,22	0,93	0,27	0,94	0,00	0,30	1,49	11,17	37,49	23,99	38,52	12,31	0,00	100
Yzma	1,16	0,84	8,29	0,22	0,89	0,29	1,23	0,00	0,29	1,45	11,03	42,25	23,55	34,20	10,03	0,00	100
Athena	1,87	1,27	10,30	0,23	0,79	0,36	1,32	0,00	0,33	1,22	7,98	39,51	20,73	39,76	12,18	0,00	100
Guava	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hera	1,42	1,62	10,89	0,35	0,81	0,23	0,95	0,22	0,41	1,41	8,41	40,85	19,91	39,24	12,82	0,00	100
Persim	1,74	1,15	11,61	0,23	0,75	0,21	1,03	0,00	0,30	1,41	8,36	41,65	19,79	38,30	13,17	0,27	100
Mango	1,58	1,09	9,71	0,23	0,59	0,00	1,16	0,00	0,30	1,08	7,19	41,09	19,84	39,07	11,41	0,00	100
Verbena	1,17	1,22	11,94	0,00	0,71	0,00	1,12	0,00	0,00	1,29	8,17	42,11	19,71	39,18	13,06	0,00	100
Perseph	1,35	0,96	11,29	0,40	0,70	0,00	1,11	0,00	0,32	1,16	7,79	41,33	18,81	39,86	13,12	0,00	100
Rajah	1,39	0,95	9,82	0,23	0,89	0,28	0,98	0,00	0,28	1,49	9,20	41,84	21,36	36,52	11,31	0,27	100
Yzma	0,89	0,60	5,32	0,99	0,00	0,00	0,00	0,00	0,00	1,73	9,81	58,12	19,32	21,56	6,30	1,00	99
Athena	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Guava	2,05	1,05	12,25	0,32	0,79	0,00	0,58	0,00	0,35	2,61	12,97	40,83	22,95	35,87	13,50	0,35	100
Hera	1,38	0,98	10,08	0,00	0,97	0,00	0,73	0,00	0,00	2,28	12,19	44,44	22,32	33,24	10,81	0,00	100
Persim	1,87	0,90	12,97	0,00	0,59	0,00	0,62	0,00	0,00	1,37	9,96	40,56	19,34	39,39	13,59	0,72	99
Mango	1,25	0,74	9,06	0,00	0,00	0,00	0,39	0,00	0,00	0,62	6,19	44,10	17,60	36,97	9,45	1,33	99
Verbena	0,66	0,53	11,39	0,00	0,62	0,00	0,33	0,00	0,00	0,87	8,29	44,92	19,02	35,82	11,73	0,25	100
Perseph	1,33	1,09	10,38	0,29	0,95	0,21	0,95	0,00	0,47	1,48	10,09	40,74	20,52	37,41	12,09	1,33	99
Rajah	1,55	1,02	10,19	1,12	0,00	0,27	0,76	0,00	0,00	1,73	11,83	39,87	22,78	36,88	12,07	0,47	100
Yzma	1,17	1,05	7,65	0,00	1,27	0,18	0,99	0,00	0,00	2,63	18,05	43,42	28,73	26,73	8,64	1,12	99

Apêndice 12 – Resultados da análise da variância (ANOVA – Médias repetidas no tempo) do perfil de ácidos graxos dos fosfolipídeos plasmáticos, comparando 3 dietas.

14:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	10.96	0.0004
TIME	3	25	39.74	<.0001
DIET*TIME	6	25	4.97	0.0018

15:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.45	0.6432
TIME	3	25	4.83	0.0087
DIET*TIME	6	25	1.36	0.2694

16:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	1.34	0.2806
TIME	3	25	15.81	<.0001
DIET*TIME	6	25	0.94	0.4866

16:1 n7

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	11.01	0.0004
TIME	3	25	29.08	<.0001
DIET*TIME	6	25	3.50	0.0118

17:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.67	0.5195
TIME	3	25	99.58	<.0001
DIET*TIME	6	25	0.79	0.5850

17:1

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.01	0.9916
TIME	3	25	2.01	0.1389
DIET*TIME	6	25	0.41	0.8677

18:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	1.92	0.1676
TIME	3	25	7.08	0.0013
DIET*TIME	6	25	1.56	0.2002

18:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	15.63	<.0001
TIME	3	25	42.55	<.0001
DIET*TIME	6	25	2.14	0.0840

18:1 n7

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	1.01	0.3800
TIME	3	25	28.31	<.0001
DIET*TIME	6	25	3.79	0.0081

18:2 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	83.09	<.0001
TIME	3	25	12.07	<.0001
DIET*TIME	6	25	9.88	<.0001

18:3 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	106.18	<.0001
TIME	3	25	8.84	0.0004
DIET*TIME	6	25	10.27	<.0001

18:3 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	1.39	0.2686
TIME	3	25	4.27	0.0146
DIET*TIME	6	25	1.21	0.3354

20:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F

DIET	2	25	4.31	0.0246
TIME	3	25	6.62	0.0019
DIET*TIME	6	25	1.33	0.2822

20:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	2.76	0.0825
TIME	3	25	0.53	0.6648
DIET*TIME	6	25	1.76	0.1480

20:2 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	14.52	<.0001
TIME	3	25	13.38	<.0001
DIET*TIME	6	25	8.70	<.0001

20:3 n6 (5,11,14)

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	8.81	0.0013
TIME	3	25	3.38	0.0340
DIET*TIME	6	25	4.01	0.0060

20:3 n6 (8,11,14)

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	278.24	<.0001
TIME	3	25	158.42	<.0001
DIET*TIME	6	25	137.02	<.0001

20:4 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	7.49	0.0028
TIME	3	25	21.69	<.0001
DIET*TIME	6	25	3.81	0.0078

20:5 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	4.75	0.0179
TIME	3	25	65.22	<.0001
DIET*TIME	6	25	1.24	0.3189

22:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	2.07	0.1477
TIME	3	73	6.70	0.0005
DIET*TIME	6	73	0.32	0.9239

22:4 n6 + 22:5 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.81	0.4562
TIME	3	25	59.05	<.0001
DIET*TIME	6	25	0.79	0.5880

22:6 n3 + 24:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.97	0.3927
TIME	3	25	21.31	<.0001
DIET*TIME	6	25	0.76	0.6069

24:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	5.51	0.0104
TIME	3	25	16.12	<.0001
DIET*TIME	6	25	0.94	0.4819

Sat

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	1.64	0.2140
TIME	3	25	7.05	0.0014
DIET*TIME	6	25	0.94	0.4837

MUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	6.53	0.0052
TIME	3	25	32.36	<.0001
DIET*TIME	6	25	1.39	0.2583

PUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F

DIET	2	25	2.21	0.1306
TIME	3	25	16.24	<.0001
DIET*TIME	6	25	0.72	0.6370

HUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	7.63	0.0026
TIME	3	25	28.74	<.0001
DIET*TIME	6	25	2.81	0.0314

NI

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	2	25	0.33	0.7227
TIME	3	25	1.58	0.2198
DIET*TIME	6	25	1.50	0.2180

Apêndice 13 – Resultados da análise da variância (ANOVA – Médias repetidas no tempo) do perfil de ácidos graxos dos fosfolipídeos das membranas plasmáticas das hemácias, comparando 3 dietas.

12:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	5.87	0.0081
time	3	25	11.28	<.0001
diet*time	6	25	1.89	0.1223

14:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	25.89	<.0001
time	3	25	98.50	<.0001
diet*time	6	25	8.76	<.0001

15:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.02	0.9810
time	3	67	38.93	<.0001

```
diet*time       6      67       0.64    0.6980
16:0
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       1.14    0.3355
time                3      67       4.27    0.0081
diet*time           6      67       0.74    0.6209
16:1 n7
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       1.83    0.1817
time                3      25       0.18    0.9082
diet*time           6      25       1.57    0.1978
17:0
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       0.95    0.4018
time                3      25      15.31    <.0001
diet*time           6      25       1.17    0.3540
18:0
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       0.02    0.9800
time                3      67      11.27    <.0001
diet*time           6      67       1.46    0.2068
18:1 n9
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       2.21    0.1305
time                3      67      16.63    <.0001
diet*time           6      67       1.44    0.2120
18:1 n7
        Type 3 Tests of Fixed Effects

                  Num     Den
Effect             DF      DF    F Value    Pr > F

diet                2      25       0.97    0.3947
time                3      25       1.87    0.1610
diet*time           6      25       1.57    0.1958
18:2 n6
        Type 3 Tests of Fixed Effects

                  Num     Den
```

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	28.31	<.0001
time	3	25	11.73	<.0001
diet*time	6	25	5.84	0.0007

18:3 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	157.13	<.0001
time	3	25	55.95	<.0001
diet*time	6	25	88.23	<.0001

18:3 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	2.21	0.1304
time	3	25	0.63	0.6053
diet*time	6	25	0.95	0.4767

20:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	1.38	0.2699
time	3	25	23.48	<.0001
diet*time	6	25	4.48	0.0033

20:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	2.05	0.1500
time	3	67	12.26	<.0001
diet*time	6	67	0.87	0.5244

20:2 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	27.25	<.0001
time	3	25	2.42	0.0901
diet*time	6	25	4.70	0.0025

20:3 n6 (5,11,14)

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	5.09	0.0140

time	3	25	4.27	0.0145
diet*time	6	25	1.42	0.2481

20:3 n6 (8,11,14)

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	300.71	<.0001
time	3	67	49.93	<.0001
diet*time	6	67	57.47	<.0001

20:4 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	8.53	0.0015
time	3	67	11.81	<.0001
diet*time	6	67	5.95	<.0001

20:5 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	2.38	0.1130
time	3	25	23.80	<.0001
diet*time	6	25	0.89	0.5190

22:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.00	0.9988
time	3	25	15.76	<.0001
diet*time	6	25	1.95	0.1121

22:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.19	0.8256
time	3	25	21.37	<.0001
diet*time	6	25	1.14	0.3668

22:4 n6

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	6.47	0.0054
time	3	25	1.32	0.2898
diet*time	6	25	1.48	0.2260

22:5 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.77	0.4740
time	3	67	20.48	<.0001
diet*time	6	67	1.38	0.2364

22:6 n3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.06	0.9401
time	3	25	5.19	0.0064
diet*time	6	25	0.46	0.8284

24:0

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	1.63	0.2159
time	3	25	7.66	0.0009
diet*time	6	25	0.36	0.8948

24:1 n9

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	2.16	0.1369
time	3	25	12.76	<.0001
diet*time	6	25	1.08	0.3987

Sat

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	1.45	0.2544
time	3	67	1.92	0.1346
diet*time	6	67	1.35	0.2493

MUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	8.89	0.0012
time	3	25	22.94	<.0001
diet*time	6	25	2.39	0.0582

PUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	5.35	0.0117
time	3	25	3.16	0.0422
diet*time	6	25	2.85	0.0297

HUFAS

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	9.90	0.0007
time	3	67	11.90	<.0001
diet*time	6	67	4.99	0.0003

NI

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
diet	2	25	0.12	0.8863
time	3	25	44.44	<.0001
diet*time	6	25	0.55	0.7660

Apêndice 14 – Normas para redação de artigos científicos para a submissão ao *Journal of Nutrition*

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See links below under "Manuscript Preparation" to view sample files for a submitted manuscript, tables, figures, and an editorial checklist.

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DIETS. Composition of control and experimental diets must be presented. When a diet composition is published for the first time in *The Journal of Nutrition,* utilize a table or a footnote to provide complete information on all components. If previously described in *The Journal of Nutrition* or *The American Journal of Clinical Nutrition,* a literature citation may be used. State specifically any modifications made to the published diet compositions. The proximate composition of closed formula diets should be given as amounts of protein, energy, fat, and fiber. Components should be expressed as g/kg diet. Vitamin and mineral mixture compositions should be included using *Journal of Nutrition* units and nomenclature. For a discussion of the formulation of purified animal diets, refer to Baker (4) and to a series of ASN publications (5-8).

STATISTICAL METHODS. Describe all statistical tests utilized and indicate the probability level (P) at which differences were considered significant. If data are presented in the text, state what they represent (e.g. means ± SEM). Indicate whether data were transformed before analysis. Specify any statistical computer programs used.

Present the results of the statistical analysis of data in the body of each and on figures per se. Use letters or symbols to indicate significant differences; define these in a table footnote or the figure legend. Provide the appropriate statistics of variability. An estimate of the error variance (SD or SEM) of group means should be displayed in figures. Standard ANOVA methodology assumes a homogeneous variance. If error variance is

tested and found to be heterogeneous, data should be transformed before ANOVA, or nonparametric tests should be used. For a discussion of variability calculations and curve-fitting procedures, see Baker (4).

E) RESULTS AND DISCUSSION Report the results of the study. Discuss the significance of the findings, interpret the results and conclusions.

F) LITERATURE CITED The Journal of Nutrition reference format will be modified to be consistent with the International Committee of Medical Journal Editors (ICMJE) recommended format for bibliographic citations with the following exception: references should include the names of all authors, unless there are more than ten, in which case list the first nine plus "et al." There is no limit on the number of citations allowed; recent literature should be comprehensively cited. The list of references must begin on a new page and should include the heading "Literature Cited." Abbreviate journal names according to the National Library of Medicine (NLM) journal abbreviations list . References should be numbered consecutively in the order in which they are first mentioned in the text.

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UNITS OF MEASURE. Most measurements must conform to *le Systeme Internationale d'Unites* (SI) (9). The metric system and the Celsius scale (º C) must be used. Concentrations should be expressed on a molar basis. Except for diet composition, convert to substance concentration, e.g., mol/L. The denominator should be L. Do not use *M,* m*M*, *N*, etc. Use one of three acceptable options to express measurements. (a) Use SI units exclusively. (b) Use SI units and, if appropriate, provide conventional units parenthetically in the text and give conversion factors in table footnotes and figure legends. (c) Use conventional units, if appropriate, and provide SI units parenthetically in

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- SI conversion website: http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
- Clinical SI conversions: http://www.unc.edu/~rowlett/units/scales/clinical_data.html
- Clinical SI conversions: http://dwjay.tripod.com/conversion.html

ABBREVIATIONS. Use only standard abbreviations. Table 2 is an abridged list of abbreviations that may be used without definition in Journal of Nutrition articles. Other standard abbreviations are listed in Scientific Style and Format (1).

If there are three or more abbreviations defined in the text, define each the first time it is used in the text and prepare an abbreviation footnote. The footnote should be associated with the first abbreviated term in the text and should be an alphabetized listing of all author-defined abbreviations and their definitions. Abbreviations should not be followed by a period and should not be pluralized (e.g. AA should represent both "amino acid" and "amino acids"). Use the verb (e.g."is" or "are") that is consistent with the context in which the abbreviation is used in the sentence. Units and statistical terms also should not be followed by a period or pluralized. Use the standard abbreviations for SI prefixes found in Young (9) and in Table 3 and those for units of measure in Table 4. Abbreviations used only in tables and figures must be separately defined in the footnotes or legend for each table or figure. Abbreviations that are in the abbreviation footnote should not be redefined in table footnotes or figure legends.

NOMENCLATURE. Chemical and biochemical terms and abbreviations and identification of enzymes must conform to the recommended usage of the International Union of Biochemistry and Molecular Biology (10). Names for vitamins, related compounds, and abbreviations for amino acids should follow the ASN nomenclature policy (11,12).

Apêndice 15 – Normas para redação de artigos científicos para a submissão ao *American Journal of veterinary research*

AVMA Journals

Journals > Instructions for *JAVMA* authors

JAVMA

Instructions for *Journal of the American Veterinary Medical Association* authors

The mission of the *Journal of the American Veterinary Medical Association* is to promote the science and art of veterinary medicine and to provide a forum for discussion and dissemination of ideas important to the profession.

- **Keywords for Authors and Reviewers**
- **Copyright Transfer Agreement**
- **Statement on Prior Publication, Concurrent Submission, Authorship, and Funding** (PDF)
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Editorial policies

The *Journal of the American Veterinary Medical Association* is a peer-reviewed general veterinary medical journal that publishes manuscripts dealing with any subject germane to the practice of veterinary medicine. For scientific manuscripts, preference will be accorded to those that have clinical or practical value.

Authors who submit manuscripts to the journal should carefully read these Instructions for Authors when preparing their manuscripts, because compliance with these instructions will help reduce delays in manuscript processing. Authors submitting manuscripts for publication in specific features of the journal should also read recent issues of the journal for examples of how such reports and features are typically organized. Authors who have additional questions are encouraged to consult with an AVMA editor prior to manuscript submission.

A manuscript is received with the understanding that it and all revisions have been approved by all authors and that neither the manuscript nor any of its parts has been published, except as an abstract less than 250 words long, or is under concurrent consideration by any other publication. The corresponding author must provide a signed statement to this effect.

A manuscript containing information published in any compiled printed (eg, journals, symposia, proceedings, newsletters, books) or electronic (eg, Web sites, CD-ROMs, DVDs) format will be rejected on the grounds of prior publication. Publication of abstracts less than 250 words long does not constitute prior publication; however, publication of longer abstracts may. At the time of manuscript submission, the corresponding author must include copies of any abstracts of the manuscript that have been published or submitted for publication or that are expected to be submitted for publication. Authors preparing abstracts for publication in a proceedings are encouraged to review the Guidelines for Preparation of Scientific Abstracts.

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Manuscript submission

Manuscripts should be submitted online at http://mc.manuscriptcentral.com/avma. Manuscripts may also be submitted by conventional mail, but online submission is recommended to expedite processing of manuscripts.

Online manuscript submission — For online submission, manuscripts must be in Microsoft Word format (.doc) or rich text format (.rtf). The manuscript (including footnotes, references, figure legends, and tables) must be double-space typed, using 12-point Times New Roman font, 1-inch margins, and left justification. Manuscripts should be arranged as follows: title page, structured abstract (when applicable), text, footnotes, references, figure legends, and tables. The title page must include the title and the first name, middle initial, and last name of each author, along with each author's professional degree, highest earned academic degree, and diplomate status (for authors who are diplomates of AVMA-recognized specialty organizations). Professional affiliations of the authors at the time of the study should be indicated. If an author's affiliation has changed since the study was performed, the author's new affiliation should be identified. If information in the text has been presented at a scientific meeting, this should be indicated on the title page. Acknowledgments, sources of funding, and the name of the corresponding author should also be included on the title page. Software programs that automatically create endnotes, footnotes, and references should not be used.

Each line and page of the manuscript must be numbered.

Tables should be included at the end of the manuscript in the same electronic file; however, if necessary, they can be saved as separate files.

All figures should be saved as separate electronic files; figures should not be embedded in the manuscript. Simple figures such as line drawings, bar graphs, and line graphs prepared in Excel should be saved as Excel files (.xls). Line drawings and graphs that were not prepared in Excel should be submitted as .TIF files; however, .JPG, .GIF, .EPS, and .BMP files are also acceptable. Figures created with software programs that use proprietary graphic formats (eg, SigmaPlot, Statistix) cannot be used; most such software programs have the capability to save figures in one of the aforementioned formats. Minimum resolution for line drawings and charts is 1,000 dots per inch.

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During submission of your manuscript, you will be requested to supply up to 5 keywords for the manuscript. Lists of the keywords that can be used are available on the AVMA Web site.
Conventional paper submission — Manuscripts should be prepared as described for online submission and mailed to *JAVMA*, American Veterinary Medical Association, 1931 N Meacham Rd, Suite 100, Schaumburg, IL 60173-4360. Three hard copies of the manuscript and three high-quality hard copies of each figure must be submitted, along with electronic copies of the manuscript and figures on a 3.5-in PC-formatted disk. Electronic files should be saved as Microsoft Word documents; electronic figures should be prepared as described for online manuscript submission.

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published or submitted for publication; and written permission from the copyright holder if the manuscript contains any tables or illustrations that have been published previously. **Manuscripts will not be considered for publication until both the Copyright Transfer Agreement and Statement on Prior Publication have been received.**

Authorship
Individuals should be listed as authors only if they 1) made a substantial contribution to the conception and design of the study, the acquisition of the data used in the study, or the analysis and interpretation of that data; 2) were involved in drafting or revising the manuscript critically for important intellectual content; and 3) will have an opportunity to approve subsequent revisions of the manuscript, including the version to be published. All three conditions must be met. Each individual listed as an author must have participated sufficiently to take public responsibility for the work. Acquisition of funding, collection of data, or general supervision of the research team does not, alone, justify authorship.

At least one author of a manuscript dealing with clinical interpretations or treatments must be a veterinarian. For multi-institutional studies, the individual who headed the study should be listed as an author, along with individuals who provided assistance with pathologic studies (eg, review of gross and histologic specimens) and statistical analyses and any other individual who had a substantial impact on the study design or made a unique contribution to the study. Individuals who submitted case material should be listed as authors only if they contributed at least 10% of the cases included in the study; individuals who contributed less than 10% of the cases should be listed in the acknowledgments. Requests to list a working group or study group in the byline will be handled on a case-by-case basis.

Acknowledgments
Acknowledgments can be used to identify important specific contributions from individuals who do not qualify for authorship. In particular, individuals who have contributed intellectually to the study or report but whose contributions do not justify authorship may be named and their function or contribution described. In general, this includes individuals who provided technical assistance (eg, individuals who performed special tests or research) and individuals who provided assistance with statistical analyses.

Acknowledgments should not include individuals whose only contribution to the study or report involved the routine performance of their normal job duties and who did not offer any unusual intellectual contribution or technical expertise. The acknowledgments should not be used simply as a method of expressing gratitude to individuals who had a minor role in the study. Acknowledgments of nonspecific groups (eg, the intensive care unit technicians) and unidentifiable groups (eg, the anonymous contributors) are not allowed.

Individuals named in the acknowledgments must have given their permission to the authors to be listed, because readers may infer their endorsement of the data and conclusions.

Funding
Authors are expected to acknowledge all sources of funding or financial support and to disclose to the editor any financial interests (including ownership, employment, consultancy arrangements, and service as an officer or board member) they have with companies that manufacture products that are the subject of their research or with companies that manufacture competing products.

Humane animal care and use
All research studies involving animals must have been performed in compliance with guidelines outlined in the *Animal Welfare Act, US Public Health Service Policy on the Humane Care and Use of Laboratory Animals, NRC Guide for the Care and Use of Laboratory Animals,* or *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (Fass 1999) or with equivalent guidelines. A manuscript containing information that suggests that animals were subjected to adverse, stressful, or harsh conditions or treatments will not be considered for publication unless the authors demonstrate convincingly that the knowledge

gained was of sufficient value to justify these conditions or treatments.

Manuscripts describing studies that involved the use of animals, including studies that involved the use of privately owned animals (eg, animals owned by clients, staff members, students, or private entities), must include a statement that the study protocol was reviewed and approved by an appropriate oversight entity (eg, an animal care and use committee or institutional review board) or was performed in compliance with institutional guidelines for research on animals. Manuscripts describing prospective studies that involved privately owned animals must include a statement indicating that owner consent was obtained.

If animals were euthanatized, the method of euthanasia must be indicated. Methods of euthanasia must comply with the *AVMA Guidelines on Euthanasia* (PDF).

Style
For questions of style, refer to the latest edition of the *American Medical Association Manual of Style*. For anatomic terms, use anglicized versions of official terms listed in the *Nomina Anatomica Veterinaria*. Refer to the latest editions of the *American Drug Index* and *USP Dictionary of USAN and International Drug Names* for proper spelling of chemical and drug names and to the latest edition of *Dorland's Illustrated Medical Dictionary* for proper spelling and use of medical terms. Refer to *Bergey's Manual of Determinative Microbiology* for spelling and correct taxonomic classifications of microorganisms.

Use of abbreviations should be kept to a minimum. Except for standard abbreviations and units of measure, all abbreviations used 3 or more times in the text, figures, and tables of a manuscript should be listed at the beginning of the manuscript, along with their definitions. These abbreviations should then be used without expansion. Abbreviations that appear only in the figures or tables should be defined in the table or figure legend. Abbreviations should not be used to begin a sentence. Except for the abbreviations ELISA, ACTH, EDTA, DNA, and RNA, abbreviations should not be used in titles. In addition, abbreviations in the structured abstract must be expanded at first mention, with the abbreviation given in parentheses after first mention of the expanded term.

Products, equipment, and drugs should be identified by chemical or generic names or descriptions. A trade name may be included in a lettered footnote if that specific product, equipment, or drug was essential for the outcome. A manuscript reporting results of a study that involved evaluation of the efficacy or safety of a pharmaceutical, biologic, or other product or in which such products were relevant to the diagnosis, treatment, or outcome will be considered only if the product is commercially available in the United States and can legally be used in the species of interest.

Body weights and temperatures must be reported in metric and traditional US (lb, oF) units. Dosages must be given on a mg/kg and mg/lb of body weight basis. All dosages must include route of administration and interval (eg, 10 mg/kg [4.5 mg/lb], IV, q 12 h).

Categories of manuscripts
Authors may submit manuscripts for publication in the *Views*, *Veterinary Medicine Today*, and *Scientific Reports* sections of the journal.

The *Views* section is a forum for exchange of ideas and includes the **Letters to the Editor** and **Commentaries**. Letters to the Editor may not exceed 500 words and 6 references. Not all letters are published; all letters accepted for publication are subject to editing. Those pertaining to anything published in the *JAVMA* should be received within one month of the date of publication. Submission via e-mail (JournalLetters@avma.org) or fax (847-925-9329) is encouraged; authors should give their full contact information including address, daytime telephone number, fax number, and e-mail address. Commentaries can relate to any aspect of the veterinary medical profession and should be submitted online at http://mc.manuscriptcentral.com/avma.

The *Veterinary Medicine Today* section promotes continuing education through didactic exercises, case discussions, and updates on clinical topics. Not every feature is published in every issue. Authors who wish to contribute a manuscript to the following features should consult the instructions for those features.

Instructions for Authors of *Veterinary Medicine Today* feature articles:

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Authors who wish to contribute a manuscript to another feature in this section should refer to recent issues of the *JAVMA* that contain that feature for general format.

The *Scientific Reports* section contains reports on important original research, clinical case reports, and concise reviews. A manuscript based on original research that involved animals with a naturally developing or experimentally induced disease or condition will be considered for publication as an **Original Study**. This includes a manuscript based on evaluation of case records accumulated during a specific period (ie, retrospective case series). A manuscript that describes features of 1 or more clinical cases will be considered as a **Clinical Report**. **Reference Point** articles are concise reviews concerning subject areas in which important advances have been made during the past 5 years and contain information that has, or will have, clinical application.

Manuscript preparation
With the exception of review articles, all manuscripts submitted to the Scientific Reports section must include a **Structured Abstract** of 250 or fewer words. For Original Studies, the structure abstract must be include the following headings: Objective, Design, Animals (or Sample Population), Procedures, Results, and Conclusions and Clinical Relevance. For Clinical Reports, the structured abstract must include the following headings: Case Description, Clinical Findings, Treatment and Outcome, and Clinical Relevance.

The text for an **Original Study** is organized under the following headings: Introduction, Materials and Methods, Results, and Discussion. The **Introduction** should supply sufficient pertinent background information to allow readers to understand and interpret results. It must include the rationale for the study, the investigators' hypothesis, and a clear statement of the purpose of the study. The **Materials and Methods** section should describe the experimental design in sufficient detail to allow others to reproduce the study. A subsection detailing statistical methods used to summarize data and test hypotheses and the level of significance used for hypothesis testing should be provided. When citing software products, use a footnote to cite software (eg, PROC GLM, SAS Institute, Cary, NC) and a reference to cite a *User's Guide* (eg, *SAS user's guide: statistics, version 5 edition*. Cary, NC: SAS Institute Inc, 1985;page number). The **Results** section should provide data that are clearly and simply stated without discussion or conclusions. Tables and figures should be cited parenthetically. Authors of manuscripts reporting gene sequences should submit those sequences to an appropriate data bank. The **Discussion** section should focus on findings in the manuscript and should be brief, containing only discussion that is necessary for interpretation of findings. The Discussion should concentrate on what is known in animals, not what is known in humans.
A retrospective case series must include a meaningful statement of purpose, clinically relevant

data, and clinically useful conclusions or interpretations derived directly from evaluation of the cases described. Except for rare conditions, retrospective case series should contain information on at least 10 animals and include appropriate statistical analyses.

A **Clinical Report** begins with the signalment of the animal or animals, followed by a chronologic description of pertinent aspects of the diagnostic examination, treatment, and outcome, and ends with a brief discussion. When more than one animal is involved, a representative of the group should be described in detail; important differences among animals can be addressed separately. For reports in which there are 3 or fewer animals, pertinent abnormal findings should be summarized in the text. For 4 or more animals, one table that provides a summary of pertinent abnormal findings may be accommodated, provided that such findings are not repeated in the text.

Footnotes
Cite footnotes by superscript, lowercase letters in the order in which they appear in the text. List footnotes alphabetically just before the references. For products and equipment, provide complete information in the footnote, including manufacturer's name and location (ie, city, state, and country [if other than the United States]). Abstracts, personal communications, and theses should be cited as footnotes.

References
Authors bear primary responsibility for accuracy of all references. References must be limited to those that are necessary and must be cited in the text by superscript numbers in order of citation. Journal titles in the Reference section should be abbreviated in accordance with the National Library of Medicine and *Index Medicus*. For references with more than 3 authors, only the first 3 authors should be listed, followed by "et al." The following is the style used for common types of references:

Article in journal
1. Lamont LA, Bulmer BJ, Sisson DD, et al. Doppler echocardiographic effects of medetomidine on dynamic left ventricular outflow tract obstruction in cats. *J Am Vet Med Assoc* 2002;221:1276-1281.

Book chapter
2. Muir P, Johnson KA, Manley PA. Fractures of the pelvis. In: Birchard SJ, Sherding RG, eds. *Saunders manual of small animal practice*. 2nd ed. Philadelphia: WB Saunders Co, 2000;1126-1132.

Proceedings
3. Moore MP, Bagley RS, Harrington ML, et al. Intracranial tumors, in *Proceedings*. 14th Annu Meet Vet Med Forum 1996;331-334.

Electronic material
4. Animal and Plant Health Inspection Service Web site. Bovine spongiform encephalopathy (BSE). Available at: www.aphis.usda.gov/lpa/issues/bse/bse.html. Accessed Feb 18, 2003.

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Limit figures to those that reduce or clarify the text. Text and symbols should be large enough that they will still be legible when the figure is reduced to one column width during publication. To ensure high-quality reproduction, symbols used in graphs should be limited to open and closed circles, triangles, and squares; axes should be labeled in Helvetica or Arial font. Keys to symbols may be placed in a small box inserted into the unused portion of graphs. Photomicrographs and electron micrographs must have an internal scale marker. To express magnification with an internal scale marker, divide the length of the marker by the original magnification. For figures that consist of multiple parts, individual parts of the figure should be identified by capital letters embedded in the figure, rather than by describing the location of the part in the legend (eg, top right).

For preparation of electronic copies of figures, please see the section on online manuscript submission. Hard copies of figures that are submitted must be identified on the back along the top margin with the first author's name, the figure number, and an arrow (or "top") indicating the top of the figure, taking care not to write in the area of interest. Radiographs and transparency slides will not be accepted for review or publication.

Figure legends must be given at the end of the manuscript. Sufficient information should be included to allow the figure to be understood without reference to the text. When applicable, stains used for histologic sections should be indicated in the legend. Authors wishing to use any previously published figures must submit written permission from the copyright holder.

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Peer-review process
The *JAVMA* reserves the right to reject any manuscript. Manuscripts submitted to the *Scientific Reports* section are subject to peer review, as are didactic exercises, case discussions, reviews of clinical topics, and features sponsored by specialty colleges or academies submitted to the *Veterinary Medicine Today* section. Manuscripts are reviewed initially by an AVMA scientific editor. Those with insufficient priority for publication are rejected promptly. Manuscripts considered for publication are sent to a minimum of 2 experts for external peer review. Instructions provided for external reviewers are available on the AVMA Web site for authors' perusal. Identity of peer reviewers is kept confidential; identity of authors is not. Authors are expected to respond to reviewer comments and make appropriate revisions within 30 days. Revised manuscripts may be rereviewed. Manuscripts that pass peer review are accepted for publication provided that authors respond meaningfully to questions and concerns raised by an AVMA scientific editor. For manuscripts that are rejected, hard copies of the text and accompanying materials will not be returned to the authors.

Sequence of publication
The *JAVMA* is published twice a month. Manuscripts are processed for publication in the order that they pass peer review, except that manuscripts dealing with emerging or zoonotic diseases or biodefense are prepared for publication as soon as they pass peer review. Adherence to these instructions and expedient revision and return of manuscripts will minimize time from submission to publication.
Version: October 26, 2007

Apêndice 16 – Cópia da página do American Journal of Veterinary Research demonstrando o andamento do processo.

Dashboard

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Manuscripts I Have Co-Authored

Manuscript ID	Manuscript Title	Date Created	Date Submitted	Status
AJVR-09-03-0085.R1	Dietary medium-chain triglycerides cause no food aversion in cats and have minimal effects on plasma lipids and lipoprotein distribution [View Submission]	27-Apr-2009	27-Apr-2009	SEC: Cafarella, Margie Provisional Acceptance (F) (29-Apr-2009)
AJVR-09-03-0085	Dietary medium-chain triglycerides cause no food aversion in cats and have minimal effects on plasma lipids and lipoprotein distribution [View Submission]	03-Mar-2009	04-Mar-2009	SEC: Cafarella, Margie Minor Revision (01-Apr-2009) a revision has been submitted

top

VITA

Luciano Trevizan, filho de Odorico Trevizan (*in memorian*) e de Maria Tittoni Trevizan, nasceu em 02 de junho de 1976, Capão da Canoa, RS.

Estudou na Escola Estadual "Lourenço Leon von Langendonk", em Maquiné, na qual completou seu estudo de primeiro grau. Na Escola Estadual Ilderfonso Simões Lopes, em Osório/RS, cursou o segundo grau. Em agosto de 1997, ingressou no Curso de Medicina Veterinária da Universidade Federal do Rio Grande do Sul (UFRGS), RS, graduando-se como Médico Veterinário em janeiro de 2003.

Em março de 2003, iniciou seu Curso de Mestrado no Programa de Pós-Graduação em Zootecnia, da Faculdade de Agronomia, da UFRGS, na área de concentração de nutrição de não-ruminantes, tendo trabalhado com nutrição de cães.

Em março de 2005, iniciou o curso de Doutorado, no mesmo Programa de Pós-Graduação. Durante o período de doutorado foi aprovado no Programa de Bolsas Sanduiche do CNPq. Em março de 2007, realizou parte do doutorado na Texas A&M University, College Station, Texas, USA, encerrando este período em março de 2008. Em fevereiro de 2009, defendeu a tese de doutorado referente ao metabolismo de lipídeos em gatos e foi aprovado no concurso para Professor Substituto do Departamento de Zootecnia da UFRGS.

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