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In Dogs Does Feeding Raw Dietary Treats Reduce or Prevent Periodontal Disease?

A Knowledge Summary by

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KNOWLEDGE SUMMARY

PICO question

In Dogs Does Feeding Raw Dietary Treats Reduce or Prevent Periodontal Disease?

Clinical bottom line

Considering the weak evidence on raw bones and lack of evidence on other types of raw treats, veterinarians and veterinary nurses should be cautious when recommending raw treats to support periodontal health in dogs. Additionally, they should advise clients accordingly by relying on their clinical experience rather than the literature until more and better quality evidence is generated.

Clinical Scenario

You are asked by a client for advice on improving the dental health of their dog after they read on the internet that periodontal disease negatively affects their dog's wellbeing. They read that feeding raw treats helps improve the dental health of their dog and are now asking you if there is evidence to support this.

The evidence

The research question effectively contains sub-questions addressing four topics: (1) preventive effects of raw treats vs. non-raw treats, (2) curative effects of raw treats vs. non-raw treats, (3) preventive effects of raw treats vs. no treats, and (4) curative effects of raw treats vs. no treats. There is currently no evidence directly comparing curative or preventive effects of raw dietary treats to non-raw treats (sub-questions 1 and 2) or for preventive effects of raw dietary treats compared to no treats at all (sub-question 3). Evidence for sub-question 4 was found in a paper by Marx et al. (2016), who described the use of two different raw bovine bone treats to reduce dental calculus. However, as this paper is a quasi-experimental non-randomised within-group comparison over time containing confounding variables, the risk of bias is judged as serious using the ROBINS-I tool (Sterne et al., 2016). Furthermore, the reporting of this paper did not adhere to guidelines for reporting non-randomised studies (Reeves and Gaus, 2004), which made a full critical appraisal difficult.

Summary of the evidence

Marx (2016)	
Population:	Experiment 1: Healthy adult (3 ± 0.5 years) laboratory housed Beagle dogs who had never undergone dental cleaning and had never received regular dental prophylaxis. Experiment 2: The same group of laboratory housed Beagle dogs, 7 months after experiment 1 finished. No dental prophylaxis was administered in-between experiments.
Sample size:	One group of 8 (4 male, 4 female)
Intervention details:	At the start of the study (day 0) dental calculus assessment was conducted and compared to experiments 1 & 2. Dogs in each study

	were provided with a bone for 12 and 20 days respectively. Experiment 1: One piece of cortical bone (incl. marrow, raw bovine femur, approx. 4 cm long, weighing 122 ± 17 g) daily for a period of 12 days. Experiment 2: Seven months after experiment 1, one piece of epiphyseal bone (incl. marrow, raw bovine femoral epiphysis, approx. 5 cm long, weighing 235 ± 27 g) was given to dogs daily for a period of 20 days. In both studies, the previous days bone was removed before administering a new bone. Bones were obtained from a commercial slaughterhouse, cut using a band saw then stored at -18 °C and thawed before use. Throughout both experiments dogs were kept in individual cages and fed twice daily with a non-dental dry extruded complete commercial diet that met approximate daily maintenance energy requirements. Water was provided *ad libitum.*
Study design:	Both experiments: Quasi-experimental non-randomised within-group baseline-to-intervention comparison over time.
Outcome studied:	Outcome 1. Experiment 1: Reduction (%) of tooth area covered with dental calculus over time (1, 3, 7, 9, 12 days) compared to baseline day 0. Outcome 2, Experiment 2: Reduction (%) of tooth area covered with dental calculus over time (1, 3, 7, 9, 12, 14, 17, 20 days) compared to baseline day 0. Both experiments: Discrete measurements made on lateral view photographs of the canines, premolars 1-4 and molars 1-2 of all arcades using Image-Pro Plus image analysis software. Outcome 3. Comparison of calculus reduction between the two experiments were compared over the twelve day period.
Main findings: (relevant to PICO question):	Outcome 1. Experiment 1: At day 0 mean dental calculus coverage was 42% of total surface of dental arcade. After 12 days a 70.6% reduction was observed to 12.3% of surface area ($P<0.05$). Outcome 2. Experiment 2: At day 0 mean dental calculus coverage was 38.6% of total surface of dental arcade. After 12 days an 81.6% reduction was observed to 7.1% ($P<0.05$) and after 20 days an 84% reduction to 4.7%. Outcome 3. No difference ($P=0.09$) was found when comparing dental calculus reduction at day 12 during experiment 1 and day 12

	of experiment 2. But a significant ($p<0.05$) reduction after day 3 was seen and was lower in experiment 1 than in experiment 2 (35.5% and 56.5% respectively).
Limitations:	• This paper describes a non-randomised study with within group comparisons over time. A reason for not using a randomised between-group comparison design was not provided, even though it appears a more straightforward option. • The comparison between the two treatments is confounded by the fact that for cortical bone, dogs had received no dental prophylaxis for three years, whereas for epiphyseal bone they received no prophylactic treatment for 7 months. Having said this, it is important to highlight the similarities between the calculus build up on the first days in the first (42% calculus coverage of dental arcades) and second study (38.6% calculus coverage of dental arcades). This could explain the reduced calculus coverage at the start of experiment 2 and/or the limited long term effect of prophylactic treatment over a 7 month period. • The sample size is very small, with a narrow age range. The reason for this is not provided. • The dogs used in this study are unlikely to be representative of pet dogs, which makes extrapolating findings troublesome. • Data in the results section did not show exact data from all days of experiments. Mean reduction was only shown in a percentage without including indicators variance. Only the p value was provided for statistics. • Extrapolations regarding efficacy compared results to other calculus reducing methods were made using the literature, even though no direct comparisons have been performed. • This paper does not adhere to guidelines for reporting non-randomised studies (Reeves and Gaus, 2004). For example, it does not explain why an RCT was not possible or reports on precautions to reduce bias, nor does it provide information on other environmental enrichment provided to the dogs under investigation.

Appraisal, application and reflection

Raw feeding has become an increasingly popular concept in companion animals in recent years (Schlesinger and Joffe, 2011; Freeman et al., 2013; Fredriksson-Ahomaa et al., 2017). Recent research (Morgan et al., 2017) highlighted that owners searching for information on raw diets are more reliant on online resources due to a lack of trust in the veterinary profession regarding this topic. This indicates the importance of veterinary practitioners having access to high quality evidence on raw feeding to educate owners during consultations. However, the evidence-base for raw feeding-related issues in dogs, and companion animals in general, is lacking with the majority of evidence being of an anecdotal nature. Most research relating to raw feeding to date has focused on nutritional risk/benefit to the animal and public health and consumer safety (for example see Finley et al., 2006; Fredriksson-Ahomaa et al., 2017; van Bree et al., 2018). Schlesinger and Joffe (2011)

argue that although some high-level evidence based on mainly North American studies is available regarding the latter, the evidence base for the former is weak. Recent work by van Veggel and Armstrong (2017) found no evidence regarding effects of feeding raw complete diets on dental health in dogs. In the current study on raw complementary feeds, this lack of evidence is similar, with no evidence available for effects on dental health of any type of dietary raw treat other than raw bones. However, the evidence on raw bones (Marx et al., 2016) is weak due to a serious risk of bias caused by limitations in the experimental design. Furthermore, weaknesses in reporting meant this research was difficult to fully appraise.

This Knowledge Summary specifically excluded research on rawhides and rawhide products. Due to the industrial techniques used to manufacture these products, the authors do not consider them to be a raw feed in the true nature of the word. The evidence of potential effects of rawhide products on dental hygiene in dogs would merit appraisal in a separate Knowledge Summary.

In all literature search strategies, the balance between sensitivity and precision of the literature search is key (O'Connor et al., 2014). Due to the nature of the evidence regarding raw feeding, similar to work by van Veggel and Armstrong (2017) and Taylor and van Veggel (2018), the search strategy for this paper was deliberately on the sensitive side so that no potential relevant papers would be missed. As a result, the authors believe the outcome of this paper to be representative of the lack of research on raw feeds and feeding, rather than it being related to the specificity of the literature search strategy. This Knowledge Summary clearly highlights a gap in the evidence, therefore a strong justification (Lund et al., 2016) for further research is present. The authors therefore recommend original research in the form of a randomised controlled study into dental health and complementary raw feeding is undertaken while keeping risks to humans caused by feed hygiene issues (van Bree et al). (2018) in mind.

Methodology Section

Search Strategy	
Databases searched and dates covered:	CAB Abstracts (1973 - June 2017) PubMed (1950 - June 2017) – Veterinary Science filter applied
Search terms:	(dog OR dogs OR canine OR canines OR bitch OR bitches) AND ('periodontal disease' OR gingivitis OR gingiva OR tartar OR plaque OR stomatitis OR periodontitis OR 'gum disease' OR 'dental disease' OR calculus) AND (feed OR diet OR food OR 'pet food' OR 'dental treats' OR treats OR snack OR chew OR bone OR knuckle OR hide OR biscuit OR titbits)
Dates searches performed:	19 June 2017

Exclusion / Inclusion Criteria	
Inclusion and exclusion criteria were determined in advance of the search phase. Papers were screened by both authors independently by title and abstract and included for analysis if they met the inclusion criteria below. Where there was doubt, papers were included. Subsequently, full-text articles were obtained and a second inclusion/exclusion phase based on the criteria below was performed. Where there was doubt about the suitability of a full text paper, an independent party was consulted and a majority vote applied.	
Exclusion:	Not related to PICO Not addressing raw complementary feed Review papers Non-peer reviewed material

Inclusion:	Primary research papers OR Systematic reviews (SR) AND Dental hygiene using any types of complementary raw feeds

Search Outcome						
Database	**Number of results**	**Excluded – not related to PICO**	**Excluded – Not peer reviewed**	**Excluded – not primary research**	**Excluded – not raw treat**	**Total relevant papers**
CAB Abstracts	368	338	5	9	15	1
PubMed	1368	1351	3	5	8	1
Total relevant papers when duplicates removed						**1**

CONFLICT OF INTEREST

Nieky van Veggel is a member of the editorial board of *Veterinary Evidence*.
This paper underwent a rigorous peer-review process as per our normal reviewing guidelines of inviting a minimum of two external reviewers. The identity of the Associate Editor handling the paper has not been disclosed to the author. The final decision to accept this paper rested with the Editor-in-chief.

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