

RABBIT IS PARTICULARLY INTERESTING TO DEPOSIT DHA IN ITS MEAT WITHOUT EFFECTS ON MEAT ORGANOLEPTIC QUALITY – A REVIEW

Lebas F., Colin M., Delarue J., Caillaud L., Van Lissum M., Prigent A.Y.

12th World Rabbit Congress, Nantes (France), 3-5 November 2021

Complete list of References

- ANSES 2011. Actualisation des Apports Nutritionnels Conseillés pour les acides gras. *Rapport d'expertise collective. Saisine n° 2006-SA-0359, ANC AG. Anses éditeur, Maisons-Alfort 323 pp*
- ANSES 2016 Actualisation des repères du PNNS (Programme National de Nutrition Santé) : révision des repères de consommations alimentaires. *Rapport d'expertise collective, Saisine n°2012-SA-0103. Anses éd., Maisons-Alfort, 192 pp*
- Barnathan G. 2007. Sources connues et potentielles de DHA pour les besoins de l'homme. *Oléagineux, Corps gras, Lipides, 14, 35-43.*
- Bernardini M., Dal Bosco A., Castellini C., 1999., Effect of dietary n-3 / n-6 ratio on fatty acid composition of liver, meat and perirenal fat in rabbits. *Animal Science, 68, 647-654.*
- Betiku O. C., Barrows, F. T., Ross, C., Sealey, W. M. 2016. The effect of total replacement of fish oil with DHA-Gold® and plant oils on growth and fillet quality of rainbow trout (*Oncorhynchus mykiss*) fed a plant-based diet. *Aquaculture nutrition, 22, 158-169.*
- Bradbury J. 2011. Docosahexaenoic acid (DHA): an ancient nutrient for the modern human brain. *Nutrients, 3, 529-554.*
- Castro-González M. I. 2002. Ácidos grasos omega 3: beneficios y fuentes. *Interciencia, 27, 128-136.*
- Chilliard Y., Ferlay A., Doreau M., 2001. Effect of different types of forages, animal fat or marine oils in cow's diet on milk fat secretion and composition, especially conjugated linolenic acid (CLA) and polyunsaturated fatty acids. *Livest. Prod. Sci., 70, 31-48.*
- Colin M., Delarue J., Caillaud L., Prigent A.Y. 2017. Effets de l'incorporation de microalgues (*Schizochytrium*) dans l'alimentation des lapins sur leurs performances et la teneur en DHA de leur viande. *17èmes journées de la recherche cunicole, Le Mans (France), 21-22 Novembre 2017, 79-82.*
- Colin M., Xi C., Prigent A.Y. 2012. L'enrichissement des aliments lapin en oméga 3 courtes et longue chaîne : une opportunité pour le producteur et le consommateur. *Cuniculture Magazine, 39, 33-43*
- Colin M., Lebas F., Delarue J., L Caillaud L., Van Lissum M., Prigent A.Y., 2020. Meat from rabbits fed vegetable DHA can be an important part of a DHA-oriented human diet. *12th World Rabbit Congress, communication in press*
- Combes S. 2004. Valeur nutritionnelle de la viande de lapin. *INRA Prod. Anim., 15, 373-384*
- Dal Bosco A., Mugnai C., Mourvaki E., Castellini C. 2007. Effet d'un accès au pâturage sur le profil des acides gras et le niveau de TBARs de la viande de lapin. *12^{èmes} Journées de la Recherche Cunicole, 27-28 novembre 2007, Le Mans, France, 195-198*
- Delarue J., Corporeau., Alain G. 2006. Intérêt des oméga-3 marins dans la prévention et le traitement du syndrome métabolique. *Médecine Thérapeutique, 12, 319-326.*
- Delarue J., Lefoll C., Corporeau C., Lucas D. 2004., N-3 long chain polyunsaturated fatty acids: a nutritional tool to prevent insulin resistance associated to type 2 diabetes and obesity. *Reprod. Nutr. Dev, 44, 289-299*
- Delarue J., Sussmann D., Guriec N., Colin M., Prigent A.Y, Dujol J., Godun K. 2017. Effet de doses croissantes de DHA végétal (*Schizochytrium* cultivé à partir de coproduits de cannes à sucre) comme source unique d'ω3 dans l'aliment sur la composition des lipides de l'œuf et ses caractéristiques hédoniques. *Journées francophones de Nutrition, Nantes, 13-15 décembre 2017, PO23.*
- Fraeye I., Bruneel C., Lemahieu C., Buyse J., Muylaert K., Foubert I. 2012. Dietary enrichment of eggs with omega-3 fatty acids: A review. *Food Research International, 48, 961-969.*
- Franklin S. T., Martin K. R., Baer R. J., Schingoethe D. J., Hippen A. R. 1999. Dietary marine algae (*Schizochytrium* sp.) increases concentrations of conjugated linoleic, docosahexaenoic and transvaccenic acids in milk of dairy cows. *The Journal of Nutrition, 129, 2048-2054.*
- Givens, D. I., Gibbs, R. A. 2008. Current intakes of EPA and DHA in European populations and the potential of animal-derived foods to increase them: Symposium on 'How can the n-3 content of the diet be improved?'. *Proceedings of the Nutrition Society, 67, 273-280.*
- Herber S. M., Van Elswyk M. E. 1996. Dietary marine algae promotes efficient deposition of n-3 fatty acids for the production of enriched shell eggs. *Poultry Science, 75, 1501-1507*
- Hooijmans C. R., Van der Zee C. E. E. M., Dederen P. J., Brouwer K. M., Reijmer Y. D., Van Groen T., Broersen L.M., Lütjohann D., Heersha A., Kiliaan A. J. 2009. DHA and cholesterol containing diets influence Alzheimer-like pathology, cognition and cerebral vasculature in APPsw/PS1dE9 mice. *Neurobiology of disease, 33, 482-498.*
- Mansour M., Shrestha P., Belide S., Petrie J., Nichols P., Singh S. 2014. Characterization of oilseed lipids from "DHA-producing *Camelina sativa*": a new transformed land plant containing long-chain omega-3 oils. *Nutrients, 6, 776-789.*
- Martek biosciences Corporation 2020. Wikipedia technical note, *On line consultation in January 2020*

- Meadus W. J., Duff P., Uttaro B., Aalhus J. L., Rolland D. C., Gibson L. L., Russel-Dugan M. E. R. 2009. Production of docosahexaenoic acid (DHA) enriched bacon. *Journal of agricultural and food chemistry*, 58, 465-472.
- Moreno-Indias I., Sánchez-Macías D., Martínez-de la Puente J., Morales-delaNuez A., Hernández-Castellano L. E., Castro N., Argüello, A. 2012. The effect of diet and DHA addition on the sensory quality of goat kid meat. *Meat science*, 90, 393-397
- Morris M. C., Evans D. A., Bienias J. L., Tangney C. C., Bennett D. A., Wilson R. S., Aggarwal N., Schneider J. 2003. Consumption of fish and n-3 fatty acids and risk of incident Alzheimer disease. *Archives of neurology*, 60, 940-946.
- Mourot J. 2010. Que peut-on attendre des pratiques d'élevage pour la viande de porcs et autres monogastriques ? *Oléagineux, Corps Gras, Lipides* 17, 37-42
- Nelson E. B., Van Elswyk M. E. 2015. Limitations of the review and meta-analysis of the role of n- 3 long-chain PUFA supplementation and cognitive function. *The American journal of clinical nutrition*, 101, 1305-1306.
- Ouhayoun J., Gidenne T., Demarne Y. 1985. Postnatal changes in the fatty acid composition of adipose tissue and muscle tissue lipids of rabbits fed a lowfat diet . *Reprod. Nutr. Dévelop.* 25, 505-519.
- Ouhayoun J., Kopp, J., Bonnet M., Demarne Y., Delmas D., 1987. Influence de la composition des graisses alimentaires sur les propriétés des lipides périrénaux et la qualité de la viande du lapin. *Science des Aliments* 7, 521-534.
- Phelps K. J., Drouillard J. S., O'Quinn T. G., Burnett D. D., Blackmon T. L., Axman J. E., Van Bibber-Krueger C.L., Gonzalez J. M. 2016a. Feeding microalgae meal (All-G Rich™; Schizochytrium limacinum CCAP 4087/2) to beef heifers. I: Effects on longissimus lumborum steak color and palatability. *Journal of Animal Science*, 94, 4016-4029.
- Phelps K. J., Drouillard J. S., O'Quinn T. G., Burnett D. D., Blackmon T. L., Axman J. E., Van Bibber-Krueger C.L., Gonzalez J. M. 2016a. Feeding microalgae meal (All-G Rich™; Schizochytrium limacinum CCAP 4067/2) to beef heifers. II: Effects on ground beef color and palatability. *Journal of animal science*, 94, 4030-4039.
- Raes K., De Smet S., Demeyer D. 2004. Effect of dietary fatty acids on incorporation of long chain polyunsaturated fatty acids and conjugated linoleic acid in lamb, beef and pork meat: a review. *Animal feed science and technology*, 113, 199-221.
- Ribeiro T., Lordelo M.M., Alves S.P., Bessa R.J.B., Costa P., Lemos J.P.C., Ferreira L.M.A., Fontes C.M.G.A., Prates J.A.M. 2013 - Direct supplementation of diet is the most efficient way of enriching broiler meat with n-3 long-chain polyunsaturated fatty acids. *Br. Poult. Sci.*, 54, 753-765.
- Robert S. S., Singh S. P., Zhou X. R., Petrie J. R., Blackburn S. I., Mansour P. M., Nichols P.D., Liu Q., Green A. G. 2005. Metabolic engineering of Arabidopsis to produce nutritionally important DHA in seed oil. *Functional Plant Biology*, 32, 473-479.
- Rodriguez-Herrera M., Khatri Y., Marsh S. P., Posri W., Sinclair L. A. 2018. Feeding microalgae at a high level to finishing heifers increases the long-chain n-3 fatty acid composition of beef with only small effects on the sensory quality. *International journal of food science & technology*, 53(6), 1405-1413.
- Sárraga C., Guàrdia M. D., Diaz I., Guerrero L., Regueiro J. G., Arnau J. 2007. Nutritional and sensory quality of porcine raw meat, cooked ham and dry-cured shoulder as affected by dietary enrichment with docosahexaenoic acid (DHA) and α -tocopheryl acetate. *Meat science*, 76, 377-384.
- Šefer D., Andonov A., Šobajić S., Marković R., Radulović S., Jakić-Dimić D., Petrujkić B. 2011. Effects of feeding laying hens diets supplemented with omega 3 fatty acids on the egg fatty acid profile. *Biotechnology in Animal Husbandry*, 27, 679-686.
- Simopoulos A.P., Salem N. 1992. Egg yolk as a source of long chain polyunsaturated fatty acids in infant feeding. *Am. J. Clin. Nutr.*, 55, 411-414.
- Smith D.M. 2017 Feeding algae to cattle at low doses to produce high omega 3 levels in beef – *US patent N°2017 / 0354168 A1*, 3 pp
- Vossen E., Van Mullem D., Raes K., De Smet S. 2010. Fatty acid composition and sensory acceptability of dry cured ham influenced by linseed oil, fish oil or microalgae included in the pig feed. *56h International congress of Meat Science and Technology (ICoMST 2010)*. 4pp
- Walsh T. A., Bevan S. A., Gachotte D. J., Larsen C. M., Moskal W. A., Owens-Merlo P. O., Sidorenko L.V., Hampton R.E., Stoltz V., Paredy D., Anthony G.I., Bhaskar P.B., Marri P.R., Clark L.M., Chen W., Adu-Peasah P.S., Wensing S.T., Zirkle R., Metz J.G. 2016. Canola engineered with a microalgal polyketide synthase-like system produces oil enriched in docosahexaenoic acid. *Nature biotechnology*, 34, 881-887.
- Winwood R. J. 2013. Recent developments in the commercial production of DHA and EPA rich oils from microalgae. *Oilseeds & fats Crops and Lipids*, 20 (6), D604.
- Zambonino-Infante J.L. 2009. Les oméga 3 dans les poissons, mythe ou réalité, à quelles conditions? Filières Terre & Mer, Oméga 3 : Au-delà des modes maîtriser pour mieux nourrir. *Colloque Adria développement, Quimper (France)*, 26 novembre 2009.
- Zhang X.W., Hou W.S., Li M, Tang Z.Y. 2016.. Omega-3 fatty acids and risk of cognitive decline in the elderly: a metaanalysis of randomized controlled trials. *Aging Clin Exp Res*, 28,165-166.

=====