Oxidation classes of samples

Methods:

Prior to analysis, the oxidation of each sample was visually classified on a scale of 1–5 (1 = white/fresh; 2 = mainly white/slight yellow tinge; 3 = white–yellow; 4 = mainly yellow/slight white tinge; 5 = yellow/sometimes a bit dry; McKinney et al. 2013).

Results:

These biopsy-like samples were visibly degraded after four and nine years of storage, but samples originating from the two individuals changed differently. Adipose tissue from both bears was initially in oxidation class 2, likely due to minor oxidation during the collection, temporary storage, and shipment. Samples were visually degraded after four and nine years of storage at –20 °C, but not at –80 °C (Table 1).

Discussion:

The extent of visual degradation between samples from the two individuals seems to indicate that FAs are degrading significantly but differently in –20 °C conditions, and deterioration may be influenced by the starting composition of the individual bear's adipose tissue. Most samples' appearance changed from the initial observations due to storage conditions, which is consistent with other studies (Lind et al. 2012, Nieminen et al. 2018). The appearance of samples stored at –20 °C changed the most over time, but the changes were greater in one individual (Bear 1). Although speculative, this might be due to the variability in concentrations of natural antioxidants present in lipid tissues, such as vitamin E. Vitamin E levels are mainly regulated by dietary intake (Katan et al. 2003). In ringed seals (*Pusa hispida*), a common polar bear prey, vitamin E concentration in blubber is bioaccumulated and thus reflects age (Käkelä et al. 1997). Through the consumption of seals of different ages, it is possible that differential decomposition between the biopsy-type samples may be related to varying levels of antioxidants between the polar bear lipid tissues.

Literature Cited

Käkelä R, Hyvärinen H, Käkelä A (1997) Vitamins A1 (retinol), A2 (3,4-didehydroretinol) and E (α-tocopherol) in the liver and blubber of lacustrine and marine ringed seals (*Phoca hispida* sp.). Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology 116:27–33

Katan M, Harryvan J, van de Bovenkamp P (2003) n-3 fatty acids in human fat tissue aspirates are stable for up to 6 y. European Journal of Clinical Nutrition 57:816–818 https://doi.org/10.1038/sj.ejcn.1601614

Table S1. Mean proportions (%) of individual fatty acids (FA) with standard deviation for adipose biopsy-type samples from polar bears (proportions of both individuals pooled) subject to different storage times and temperatures. Bolded values are significantly different from the initial samples (*0Yr*) as indicated by Dunnett's tests run for individual FAs. FAs with an asterisk indicate FAs that are primarily sourced through diet.

		Storage Condition				
	FA	**0Yr**	**4Yr, –20°C**	**4Yr, –80°C**	**9Yr, –20°C**	**9Yr, –80°C**
SFA	14:0	2.94 (± 0.31)	2.87 (± 0.37)	2.58 (± 0.32)	3.46 (± 0.58)	2.89 (± 0.25)
	15:0	0.22 (± 0.08)	0.26 (± 0.10)	0.22 (± 0.09)	0.28 (± 0.11)	0.24 (± 0.08)
	16:0	6.33 (± 1.90)	6.96 (± 2.26)	6.21 (± 1.99)	8.09 (± 2.58)	6.65 (± 1.65)
	iso15:0	0.28 (± 0.05)	0.29 (± 0.05)	0.24 (± 0.05)	0.36 (± 0.08)	0.31 (± 0.12)
	iso16:0	0.10 (± 0.03)	0.11 (± 0.06)	0.10 (± 0.03)	0.13 (± 0.04)	0.12 (± 0.03)
	7Me16:0	0.16 (± 0.03)	0.18 (± 0.03)	0.16 (± 0.03)	0.19 (± 0.03)	0.18 (± 0.03)
	iso17:0	0.11 (± 0.01)	0.12 (± 0.01)	0.10 (± 0.01)	**0.13 (± 0.01)**	0.10 (± 0.00)
	17:0	0.15 (± 0.05)	0.18 (± 0.06)	0.14 (± 0.05)	0.20 (± 0.07)	0.16 (± 0.05)
	18:0	1.85 (± 0.27)	2.05 (± 0.31)	1.84 (± 0.25)	**2.54 (± 0.39)**	2.08 (± 0.33)
	20:0	0.10 (± 0.02)	0.10 (± 0.02)	0.10 (± 0.01)	0.13 (± 0.03)	0.11 (± 0.03)
MUFA	14:1n5	0.44 (± 0.01)	**0.37 (± 0.02)**	**0.35 (± 0.01)**	0.44 (± 0.03)	0.42 (± 0.02)
	16:1n11	0.27 (± 0.08)	**0.46 (± 0.14)**	0.27 (± 0.07)	0.28 (± 0.09)	0.28 (± 0.07)
	16:1n9	0.47 (± 0.03)	0.51 (± 0.06)	0.47 (± 0.04)	0.48 (± 0.06)	0.50 (± 0.12)
	16:1n7	7.38 (± 1.19)	7.65 (± 1.15)	7.16 (± 1.22)	7.55 (± 1.47)	7.18 (± 1.03)
	17:1	0.19 (± 0.02)	0.20 (± 0.02)	0.18 (± 0.02)	0.19 (± 0.03)	0.17 (± 0.02)
	18:1n11	6.37 (± 0.64)	7.34 (± 1.05)	6.82 (± 0.85)	7.20 (± 1.09)	6.85 (± 1.26)
	18:1n9	20.11 (± 3.49)	22.07 (± 4.1)	20.51 (± 3.55)	21.45 (± 3.51)	19.12 (± 3.09)
	18:1n7	3.35 (± 0.07)	**3.67 (± 0.09)**	3.43 (± 0.09)	**3.74 (± 0.10)**	3.47 (± 0.27)
	18:1n5	0.41 (± 0.05)	0.47 (± 0.06)	0.43 (± 0.06)	0.45 (± 0.06)	0.41 (± 0.04)
	20:1n11*	4.97 (± 0.73)	5.62 (± 0.80)	5.30 (± 0.76)	**6.18 (± 0.95)**	5.50 (± 0.60)
	20:1n9*	16.83 (± 1.08)	17.55 (± 1.26)	16.42 (± 1.03)	**19.45 (± 1.77)**	17.38 (± 1.56)
	20:1n7*	1.15 (± 0.09)	1.27 (± 0.10)	1.19 (± 0.09)	**1.36 (± 0.09)**	1.23 (± 0.06)
	22:1n11*	5.58 (± 0.35)	5.94 (± 0.35)	5.59 (± 0.34)	**6.66 (± 0.38)**	5.83 (± 0.33)

	22:1n9*	1.50 (± 0.09)	1.60 (± 0.08)	1.52 (± 0.08)	**1.81 (± 0.10)**	1.60 (± 0.05)
	22:1n7*	0.17 (± 0.03)	0.20 (± 0.02)	0.20 (± 0.04)	**0.21 (± 0.02)**	0.19 (± 0.02)
	24:1n9	0.18 (± 0.03)	0.21 (± 0.03)	0.19 (± 0.03)	**0.26 (± 0.03)**	0.20 (± 0.03)
PUFA	16:2n4*	0.11 (± 0.02)	**0.15 (± 0.01)**	**0.15 (± 0.01)**	0.14 (± 0.03)	**0.17 (± 0.04)**
	16:3n6*	0.25 (± 0.04)	0.23 (± 0.06)	0.26 (± 0.05)	**0.16 (± 0.06)**	0.24 (± 0.06)
	18:2n6*	1.42 (± 0.12)	1.27 (± 0.19)	1.46 (± 0.11)	**0.92 (± 0.22)**	1.32 (± 0.15)
	18:3n4*	0.12 (± 0.01)	0.14 (± 0.07)	0.12 (± 0.06)	0.07 (± 0.03)	0.06 (± 0.01)
	18:3n3*	0.35 (± 0.01)	0.30 (± 0.06)	0.39 (± 0.02)	**0.18 (± 0.06)**	0.32 (± 0.05)
	18:4n3*	0.53 (± 0.22)	0.36 (± 0.20)	0.55 (± 0.23)	**0.17 (± 0.12)**	0.51 (± 0.23)
	20:2n9	0.11 (± 0.02)	**0.17 (± 0.02)**	0.14 (± 0.07)	**0.18 (± 0.03)**	0.13 (± 0.01)
	20:2n6*	0.29 (± 0.01)	0.26 (± 0.03)	0.30 (± 0.02)	**0.24 (± 0.03)**	0.31 (± 0.01)
	20:3n6*	0.11 (± 0.01)	**0.07 (± 0.02)**	0.10 (± 0.01)	**0.04 (± 0.01)**	0.09 (± 0.01)
	20:4n6*	0.22 (± 0.07)	0.13 (± 0.05)	0.21 (± 0.06)	0.10 (± 0.05)	0.29 (± 0.20)
	20:4n3*	0.31 (± 0.04)	0.23 (± 0.07)	0.32 (± 0.05)	**0.12 (± 0.06)**	0.30 (± 0.06)
	20:5n3*	1.73 (± 0.98)	0.96 (± 0.67)	1.63 (± 0.97)	**0.44 (± 0.40)**	1.66 (± 1.02)
	21:5n3*	0.23 (± 0.00)	**0.14 (± 0.03)**	0.25 (± 0.03)	**0.07 (± 0.03)**	0.23 (± 0.03)
	22:5n6	0.12 (± 0.01)	**0.05 (± 0.03)**	0.11 (± 0.01)	**0.03 (± 0.01)**	0.09 (± 0.02)
	22:5n3	4.37 (± 0.52)	**2.56 (± 0.77)**	4.54 (± 0.40)	**1.17 (± 0.58)**	4.06 (± 0.52)
	22:6n3*	6.77 (± 0.42)	**3.34 (± 1.28)**	6.51 (± 0.59)	**1.39 (± 0.91)**	5.70 (± 1.69)