

1.6, 4.4 µg/L) higher blood lead concentrations than non-consumers. Persons who consumed all three game meat types (venison, moose and birds) had 5.0 µg/L higher blood lead concentrations than those who did not consume any. The results also showed that recent game meat consumption (<1 month ago) and serving size was associated with blood lead (Iqbal et al., 2009).

4.6.1 The Norwegian Fish and Game study, the MoBa Validation study and the Lake Mjøsa study

None of the studies were designed specifically to examine associations between game meat consumption and blood lead concentration. However, all three studies had available data on blood lead concentrations and the consumption data were acquired using the same FFQ.

In the Norwegian Fish and Game and Lake Mjøsa studies, associations between game meat consumption and blood lead concentrations were studied in men and women separately, because statistical analyses showed an interaction with sex on the association between game meat consumption and blood lead concentrations in the Norwegian Fish and Game study.

Blood lead concentrations were higher in men than in women, median 28 versus 21 µg/L in the Norwegian Fish and Game study, and median 29 versus 22 µg/L in the Lake Mjøsa study. In unadjusted analyses in these studies there were no differences in blood lead concentrations between participants with regard to game meat consumption. However, when socio-demographic and lifestyle variables were taken into account, a consistent increase in blood lead concentrations in men in the Norwegian Fish and Game study was seen for increasing intake of total game meat as well as for the highest intake (more than one meal per week) of meat from moose and/or deer. Those who reported more than weekly intake of moose and deer meat (n=9) had significantly ($p<0.01$) higher blood lead concentrations than non-consumers (n=29), while no difference was seen for intake of one meal per month (n=13), two to three meals per month (n=15) or four meals per month (n=18). Intake of reindeer or grouse meat was not associated with blood lead concentrations, while intake of offal from game was significantly associated with higher blood lead concentrations (Appendix I). In Norway, reindeer meat for purchase in shops is mainly from tame reindeer slaughtered by professional butchers and not hunted (Chapter 3.2). Grouse was still shot with lead hail at the time of the study. The reported consumption was very low in all three population groups. Moose and deer are mainly hunted with lead-containing ammunition (see Chapter 3.3.7). It must be pointed out that none of the three studies were originally designed to study the association between game meat consumption and concentration of lead in blood.

No associations between game meat consumption and blood lead concentrations were observed in women in MoBa Val, the Norwegian Fish and Game and the Lake Mjøsa studies. Gender differences in the disposition and toxicity of metals are well known (Vahter, 2007). Men have generally higher blood lead level than women, partly due to higher exposure, but as lead in blood is bound to erythrocytes, also due to higher blood hematocrit levels (Pirkle, 1998; Becker, 2002). Hence, blood lead concentration is influenced by different factors in men and women and is not a direct result of external exposure only.

4.6.2 The Norwegian Game and Lead study

The study was conducted in 2012 to specifically study associations between game meat consumption and blood lead concentrations. The analysis also explored factors other than game meat consumption that contributed to the variation in blood lead levels.