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(b) In wheat flour under storage conditions: Several studies have examined the retention and stability of vitamin A in wheat flour under varying temperatures, storage conditions and durations, and in a variety of wheat flour products. A study in the Philippines reported ~81% retention of vitamin A in VA-fortified wheat flour stored for one month (Solon et al. 1998). When the fortificant included both vitamin A (500 RE/100 g flour) and iron (45 mg/kg flour) vitamin A losses were <30% after one month of storage. Other studies have shown retention rates to exceed 95% for up to a year under temperatures of $\geq 40^{\circ}$ C in low-extraction wheat flour (Liu I, 1979). Cort et al. found vitamin A losses to be higher in flour stored at 45° C vs. room temperature and as high as ~29% if the flour was stored for 3 mo under the higher temperature conditions (Table 10). High moisture content, however, may markedly increase losses (Arya SS, 1990).

(c) In wheat flour products: Several trials have examined the stability of vitamin A by itself and/or mixed with other added nutrients, in wheat-flour products. Vaghefi found that approximately 70% of vitamin A activity remained after baking traditional Persian bread products with fortified flour (Borenstein B, 1969; Vaghefi SB, 1975). Cort (1976) found no losses of vitamin A after baking bread or after five days of storage based on the level claimed by the product label. Data from F. Hoffman La Roche report ~10-20% vitamin A losses during bread baking and 13% and 17% losses after drying and cooking long durum wheat pasta, respectively (Table 10).

 **(d) Vitamin and nutrient interactions.** The magnitude of vitamin A losses appears to differ by wheat flour product and the inclusion of specific other nutrients or form of nutrients added to the flour. In the Philippines, Solon et al reported losses of vitamin A in loaf bread baked and raw noodles (prepared from hard flour) and biscuits (prepared from soft flour) ranging from 3% to 46% (Solon et al. 1999) using 3 different vitamin A-iron premixes. The vitamin A losses were consistently higher for loaf bread and noodles (40% and 46%) when the iron fortificant was ferrous fumarate compared with ferrous sulfate (21% and 28%) or reduced iron (3% and 21%) for loaf bread and noodles, respectively. However, it is important to point out of the different compounds can vary from manufacturer to manufacturer. Vitamin A losses were 20-30% in biscuits irrespective of the type of iron fortificant used. Rubin et al. (1977) investigated the stability of bread made from flour enriched by the 6 vitamins and 4 minerals described by Cort et al. (1976). They found that the inclusion of calcium and magnesium adversely affected vitamin A retention during the baking process.

7.3 Organoleptic qualities of vitamin A fortified wheat flour

Sensory tests have been conducted on flour and wheat-flour based products prepared with vitamin A. Solon et al (1998) found no differences in color or odor of VA-fortified (fortified at a level of 490 ug RE/kg) flour until three months after fortification. Similarly, no differences were found in the flavor of pandesal when fortified flour stored for 1-3 months was baked under controlled conditions, but differences in taste were observed when the pandesal was baked at local (and presumably less controlled) bakeries. However, when a similar study was repeated using flour fortified with vitamin A (500 ug