

## Evidence for Formaldehyde Antibodies and Altered Cellular Immunity in Subjects Exposed to Formaldehyde in Mobile Homes

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**ABSTRACT:** Eight symptomatic individuals chronically exposed to indoor Formaldehyde at low concentrations (0.07-0.5 ppm) were compared to 8 non-Exposed subjects with respect to: (1) presence of IgG and IgE antibodies to HCHO conjugated to human serum albumin; (2) the percentage of venous T and B cells by E and EAC-rosetting; (3) the ability of T and B cells to undergo mitogen (PHA, PWM) stimulated blastogenesis as measured by the incorporation of tritiated thymidine. Anti-F-HSA IgG, but not IgE antibodies were detected in the sera of the 8 exposed subjects; none were found in 7 of the unexposed controls. T lymphocytes were decreased in the exposed ( $48 \pm 11.5\%$ ) compared to the controls ( $65.9 \pm 4.97\%$ ) subjects ( $p > .001 < .01$ ). B cells were  $12.5 \pm 1.6\%$  (HCHO group) and  $14.75 \pm 2.1\%$  ( $p < .01 > .05$ ). The incorporation of labeled thymidine by T cells (PHA) was decreased ( $17,882 \pm 2,293$  cpm (HCHO) Group and  $28,576 \pm 3,807$  cpm ( $p > .001 < .01$ ). T and B cell blastogenesis (PWM) was  $9,698 \pm 1,441$  cpm (HCHO group) and  $11,279 \pm 1,711$  (controls) ( $p > 0.05 < .1$ ). Exposure to HCHO appears to stimulate IgG antibodies to F-HSA, and decrease the proportion of peripheral T cells.

**Introduction** CHRONIC EXPOSURE to low concentrations of formaldehyde (HCHO) in indoor air is Common in Occupational and non-occupational environments.<sup>1-3</sup> These individuals have many health complaints that involve the skin, eyes, upper and lower respiratory tract, central nervous system, and the gastro-intestinal tract.<sup>1-6</sup> Symptoms suggest systemic involvement and may reflect that HCHO acts as a hapten to produce antibodies.<sup>7-12</sup>

Individuals chronically exposed to low concentrations of indoor HCHO have fatigue, headache, vertigo, and upper and lower respiratory irritation that are difficult to classify by a single mechanism.<sup>2,7</sup> Early observations, however, indicate that HCHO is a hapten, binding to human serum albumin (HSA) to form a new antigenic determinant, F-HSA.<sup>8</sup> Recently, IgE antibodies to F-HSA have been demonstrated in anaphylactic

hock caused by HCHO in long-term hemodialysis.<sup>9</sup> Also, IgG and IgM hemolytic anti-HCHO red blood cell (RBC) antibodies are present under similar hemodialysis conditions.<sup>10,11</sup> Moreover, an anti-F-HSA IgG has been produced in dogs by the intravenous administration of HCHO and F-DNA.<sup>12</sup> More recently, IgG antibodies to F-HSA have been found in asymptomatic renal dialysis patients, IgE antibodies in two nurses with a history of HCHO asthma, and no antibodies in two physicians with HCHO rhinitis.<sup>13</sup> Airborne HCHO apparently conjugates with proteins of the upper respiratory tract.<sup>14</sup> This study examined for antibodies to F-HAS in subjects chronically exposed to low concentrations of HCHO in indoor air. In addition, the numbers and blastogenesis of peripheral T and B lymphocytes were studied.

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