

THE ROLE OF POTENTIAL IMMUNOGENIC
COMPONENTS OF DUST (MOD) IN THE
SICK-BUILDING-SYNDROME.

Suzanne Gravesen
ALK, Environment Dept.
DK 2970 Hørsholm, Denmark

Peder Skov
SAS, Occupational Health Dept.
DK 2770 Kastrup, Denmark

Ole Valbjørn
Danish Building Research Inst.
DK 2970 Hørsholm, Denmark

Henning Löwenstein
ALK-Research
DK 2970 Hørsholm, Denmark

Based on our knowledge that organic dust of biological nature partly influences the immune system and partly has a toxic and irritative effect, absorbed dust from floors and carpets in 14 Danish Town Halls - along with traditional indoor climate parameters - was collected and analysed for content of potential immunogenic components. These can be defined as Macromolecular Organic Dust components of biological origin (MOD).

A questionnaire was completed by 3500 employees at the Town Halls. By logistic regression analyses, a high correlation between MOD and mucosal symptoms, as well as general symptoms, was demonstrated in this study.

Recent studies from other groups as well as the above mentioned support our hypothesis that MOD is an aetiological factor in the Sick-Building-Syndrome.

INTRODUCTION

From clinical allergy and occupational medicine it is well known that organic dust of biological nature may influence the human immune system and may have a toxic or irritative effect (1,2,3). From field study observations it has been noticed that an increasing number of people occupied in offices, schools and other non-industrial workplaces with a heavy personal traffic complain of symptoms which apart from physico-chemical origin could be due to biological agents connected to dust (4). We therefore included determination of the macromolecular organic dust-components of biological origin (MOD) in the Town Hall Study to correlate this parameter to the work-related complaints expressed in the questionnaires.

MATERIALS AND METHODS

Sampling

From fourteen different Town Halls removable floor-dust was collected by vacuum cleaning in a study office and in an office with many daily clients. The standardized sampling procedure was carried out as described by Peder Skov et al. (5). From the dust samples the amount of MOD was determined as described in Löwenstein (6) and expressed in mg/g removable floor dust.

Questionnaire

The study population included 4,369 employees at the Town Halls. Among these persons 3,109 participated in the clinical study as well as in the questionnaire study. All questions are described in The Town Hall Study (6). Questions about presence of symptoms from mucous membranes, presence of general symptoms, the frequency and time variations of such symptoms were included.

Statistical methods

Logistic regression analyses were used in order to find possible correlation between parameters measured and the symptoms registered.

RESULTS AND DISCUSSION

The logistic regression of office equipment, number of employees, floor dust system and type of floor dust showed a high correlation between the amount of dust and the prevalence of mucosal symptoms. Other parameters closely related to the amount of floor dust (g/m^2 , floor dust) also showed influence on the prevalence of symptoms. The hypothesis behind the results is based on our knowledge of the effect of proteins, rigid carbohydrates and biologically active substances on the immune system. Dust-particles will be inhaled and deposited on the mucous membranes and mucosal fluids of the upper respiratory tract. Components will occur. The effect on the immune system and may be some of the mucosal symptoms affecting the immune system. Modes of exposure from dust from particles with the potential to affect the mucosa. Finally possible development from microorganisms should be considered.

A recently performed investigation of indoor air-quality in schools showed a high correlation between the amount of dust and the prevalence of symptoms. The analysis requires amount of dust necessary. Modification of the study is possible to perform the

RESULTS AND DISCUSSION

The logistic regression analyses which take parameters such as office equipment, number of persons, age of buildings, ventilation system and type of floor into consideration demonstrated a high correlation between the amount of macromolecular organic dust-molecules of biological origin (range: 0-5,24 mg MOD/g dust) and the prevalence of mucosal and general symptoms.

Other parameters closely correlated to MOD-amounts such as amount of floor dust (g/m^2 , fleece-index, shelf-index and floor-covering also showed influence on the symptoms of the employees (5).

The hypothesis behind demonstration of MOD from absorbed dust is based on our knowledge of macromolecules of biological origin i.e. proteins, rigid carbohydrates and DNA-molecules which are biologically active substances as they act as immunogenes (7).

Dust-particles will be liberated to the air resulting in inhalation and deposition on the human mucosa. Subsequent extraction with mucosal fluids of the water-soluble molecules from the dust components will occur. The macromolecules from the dust influence the immune system and may account for the general symptoms and some of the mucosal symptoms (8). Apart from the antigen exposure affecting the immune system the subjects are also affected by other modes of exposure from dust: a mechanical or chemical influence from particles with the possibility of irritation of skin and mucosa. Finally possible toxic reaction from the organic volatiles developed from microorganisms should also be taken into consideration.

A recently performed investigation on air-pollution sources and indoor air-quality in schools (9) showed a similar tendency towards high correlation between MOD and symptoms.

The analysis requires amounts of dust, which make sampling of floor dust necessary. Modification of the analysis hopefully will make it possible to perform the analysis on airborne dust.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above observations it is suggested that many vague complaints from non-atopic persons in non-industrial workplaces and also very strong reactions observed in industrial workplaces e.g. by workers handling garbage in waste deposits are due to prolonged exposure to organic dust (10).

Concerning prevention of exposure to organic dust in non-industrial occupations carpets should be avoided in rooms with heavy personal traffic especially from persons coming from the outside (11). Floors and especially carpets, - if they are necessary -, should be kept thoroughly clean. The rooms should be equipped without other fleecy surfaces and open shelves as these act as dust depots.

Investigation of the biological activity of dust on the human system - apart from the traditional allergic reactions - is needed. The role of microbial antigens and toxins in the Organic Dust Toxic Syndrome (ODTS) needs further elucidation as S-B-S could be a minor manifestation of the ODTS.

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