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Features of Grain Dust in a Production Environment

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Summary: Exposure to flour dust can be found in the food industry and animal feed production. It may result in various adverse health outcomes from conjunctivitis to baker's asthma. In this paper, flour dust exposure in the above-mentioned occupational environments is characterized and its health effects are discussed. A peer-reviewed literature search was carried out and all available published materials were included if they provided information on the above-mentioned elements. The hitherto conducted studies show that different components of flour dust like enzymes, proteins and baker's additives can cause both non-allergic and allergic reactions among exposed workers. Moreover, the problem of exposure to cereal allergens present in flour dust can also be a concern for bakers' family members. Appreciating the importance of all these issues, the exposure assessment methods, hygienic standards and preventive measures are also addressed in this paper.

Keywords: flour dust; flour allergens; wheat proteins; baker's asthma; exposure assessmen.

Introduction The American Conference of Governmental Industrial Hygienists (ACGIH) defines 'flour' as a complex organic dust containing cereals like wheat (Triticum sp.), rye (Secale cereale), sorghum (Panicum miliaceum), bar ley (Hordeum vulgare), oats (Avena sativa), rice (Oryza sativa) or corn (maize) (Zea mays), or a combination of these, which have been processed by milling.[1] Whereas the term 'flour dust' refers to particles coming from finely milled cereal or non-cereal grains, 'grain dust' consists of particles produced during grain harvesting and han dling, excluding milling. Flour dust usually contains var ious components which play an important role in dough improvement, such as a variety of enzymes (α-amylase, cellulase, hemicellulase, malt enzymes, xylanase, pro tease, lipase, glucoamylase, glucose oxidase, lipoxyge nase), additives (baker's yeasts, egg powder, milk powder, sugar), flavorings, spices, chemical ingredients (preserva tives, antioxidants, bleaching agents) but may also com prise of storage-related contaminants, such as microbes or mites. Grain dust may contain dry plant particles (non grain plant matter) such as fungi (mainly from Fusarium, Aspergillus, Cladosporium and Alternaria genera) with their mycotoxins, bacteria with their fragments (including endotoxins) and excretions (proteolytic enzymes), mites, insects, rodent excrements, sand and residues of pesticides. As grain dust has different health effects from flour dust, it will not be included in this paper.

2. Biological and physical characteristics of flour dust In terms of biological activity, cereals belonging to the family Poaceae are the most important. While particles derived from wheat (Triticum sp.), barley (Hordeum sp.), rye (Secale cereale) and oats (Avena sativa) have high allergenic potency, the flour dust coming from corn (Zea mays) is much less reactive.[2] Important flour dust sensi tizers, however, derive also from non-cereal grains such as soy (Glycine hispida), buckwheat (Fagopyrum escu lentum) and peas (Pisum sativum). The main cereal grain used in the bakery industry is wheat. The wheat seed is composed of endosperm (80–85%), husk and germ. Dur ing the milling process, the endosperm is separated from husk and germ and reduced to small (≤6 μm) particles.[3] Wheat flour contains starch and four groups of proteins: glutelins (glutenins), water-soluble albumins, prolamins (gliadins) and globulins. Glutenins and gliadins form com plexes called gluten. Albumins and globulins have shown the strongest allergic potency among wheat proteins, but allergic potency of globulins, prolamins and glutelins should be considered in occupational risk assessment as well.[4] According to Sander et al.,[5] wheat flour con tains 40 allergens at least, which can cause adverse health effects in exposed workers. Proteins with potential aller genic activities represent about 10–15%

of wheat grain dry weight. Wheat protein allergens have a mass of about 12–17 kDa, but the mass of their major types belonging

Occupational exposures to flour dust Cereal flour is one of the basic materials used in the food industry and animal feed production. Taking into account the character of occupational activities in those branches, the most severe exposure to flour dust is usually observed in bakeries and grain mills. A significant exposure to flour dust occurs also in pasta factories, pizza bakeries, con fectionery (cake and cookie factories), restaurant kitchens, malt factories, animal feed plants and in agriculture. The level of exposure is conditioned by the size of the production enterprise and varied depending on the work ing area within the factory grounds. In baking and milling industries, the observed concentrations of total flour dust varied from a few up to more than 400 mg/m3 in the case of peak exposure.[34,50–54] According to Bachmann and Myers, average total dust concentrations among South African milling workers fluctuated from 1.3 mg/m3 for millers, through 3.5 mg/m3 for cleaners, sweepers and bag handlers, to 17.6 mg/m3 for shovel workers andgrain pack ers. Similar average concentration levels were obtained by Kakooei and Marioryad [55] among Iranian flour mill workers reaching 11.1, 12.6, 16, 11.4 and 9.5 mg/m3 of total dust for millers, packers, sweepers, sift and wash ing operators, respectively. Awad el Karim et al. [56] noticed average total dust concentrations of 1.4, 1.6, 2.2, 2.7, 3.5 and 3.6 mg/m3 in wheat store, packing, rollers, 244 A. Stobnicka and R.L. Górny wheat cleaning, sacks and plan sifter rooms, respectively. According to Talini et al.,[57] the highest total dust concen trations of 0.4, 5.8, 6.9 and 8.7 mg/m3 were noticed at flour mill, grain cleaning, packing and unloading areas, respec tively. However, the maximal concentrations of respirable dust at some workplaces in flour mills can even reach 160 mg/m3.[53] In both small- and large-scale bakeries, exposure lev els have been found to be the highest during mixing and baking stages; however, in larger bakeries addition ally during receipt and opening of flour containers.[58] Elms et al. [59] studying work conditions in UK bak eries observed differences in the concentrations of inhal able dust exposure. The highest dustiness levels were observed in large size bakeries (with median dust concen trations of 7.6 mg/m3) followed by medium (5.2 mg/m3) and small–micro size plants (2.2–3 mg/m3). The same situation is true in the case of α-amylase for which expo sure in large industrialized bakeries was higher than in small traditional bakeries. The most severe condi tions are usually observed during dispensing, mixing or dough-making tasks. The concentrations for total dust and its inhalable fraction range from 0.4 to 86 mg/m3 and from 0.4 to 37.7 mg/m3, respectively.[8,11,13,18,50,60 67] The tasks performed by oven workers also involve risk of exposure to high concentrations of both inhalable (0.1–8.7 mg/m3) and total flour dust particles (0.1–37.6 mg/m3).[11,13,14,18,57,60,68] In a pasta manufacturing plant, the highest flour dust concentrations of 13, 3.1 and 0.2 mg/m3 for inhaled, thoracic and respirable frac tions, respectively, were observed during dough knead ing on the manual production line.[69] The concentra tions of α-amylase in the air of crisp bread bakeries can reach 229.3 ng/m3.[1] Airborne concentrations of cellu lose and xylanase in flour mills and crisp bread factories can approach 180 and 200 ng/m3, respectively; however, according to Vanhanen et al., such high concentrations of xylanase are associated with natural xylanase activity of wheat.[8,] Exposures to high concentrations of flour dust are fre quently observed; however, they usually have a short-term character and the duration of peak concentrations (2–6 peaks/h on average) usually takes from 30 s to 4 min. Lilienberg and Brisman [71] examined the occupational peak exposure for dough makers and bread formers. From among different activities, dough mixing as well as tip ping and manual handling of flour were the dustiest tasks. Cleaning the bins in bakeries and maintenance cleaning in mills have given peak values (total flour dust) of 390 and 458 mg/m3, respectively.[34] Meijster et al. [12] studying exposure to total dust in industrial and traditional bakeries, factories producing ingredients for the baking industry (i.e., pre-mixes based on flour or other bulk and special ized additive mixtures for bread or pastry) and flour mills recorded the maximal concentrations on the extremely high levels reaching 292, 318, 627 and even 1837 mg/m3, respectively. Mounier-Geyssant et al. [6] suggest that concentration of flour dust may depend on season being greater in winter than in summer. Average personal exposure of bakery and pastry apprentices to 2.5 μm particulate matter (PM2.5) were 0.71 and0.35 mg/m3 aswellas0.5and0.29 mg/m3 in winter as well as summer seasons, respectively. The same trend was noted for personal exposure of workers to PM10 (1.1 and 0.47 mg/m3 as well as 0.63

and 0.44 mg/m3 in winter as well as in summer, respectively). The risk of adverse health outcome occurrence is closely related to the flour dust exposure levels.[14] DeMers and Orris [74] showed that US bakers appeared to have markedly higher mortality rates than expected, suffering from the typical asthma-like symptoms, such as cough, wheezing and shortness of breath. Such effects were observed among bakery workers exposed to flour dust concentrations between 2 and 5 mg/m3, but they may also occur at lower levels. According to the Dutch Expert Committee on Occupational Standards (DECOS),[8]an additional sensitization risk for wheat and other cereal f lours (expressed as 8-h time-weighted concentration) is equal to 0.1%, 1% and 10% for an occupational exposure to 0.012, 0.12 and 1.2 mg/m3 of inhalable dust, respec tively. The Swedish investigations carried out among bak ers showed significant relationships between the risk for asthma and rhinitis and dust concentrations (of 3 and 1 mg/m3, respectively).[33] Studies by Houba et al. [64,76] revealed that there is a statistically significant relationship between inhalable dust fraction and wheat allergen expo sures and the risk of sensitization among bakery workers. The increased risk of sensitization is visible at wheat flour dust concentration of 2 mg/m3. Sensitization is still preva lent when flour dust concentrations reached 1 mg/m3 and its reduction to the negligible level is achieved when the concentrations of inhalable dust and wheat allergens are reduced to 0.5 mg/m3 and 0.2 μg/m3, respectively. Arecent study by Tagiyeva et al. [9] showed that the problem of exposure to cereal allergens derived from flour dust concerns not only workers but their family members as well. In a situation of such para-occupational expo sure, family members are exposed to sensitizers, which are ‘taken home’ by bakers on contaminated skin and clothes. Ahigh exposure to WFA and FAAresulted in allergic sen sitization which was noticed when bakers wore, changed or cleaned working clothes and shoes inside their living places. It was also shown that wheezing symptoms and asthma were more prevalent among children whose fathers were occupationally exposed to flour dust. The study by Tagiyeva et al. included also the workplace evaluation as well as bakers’ vehicles and homes demonstrating that after routine hygiene measures bakers leave workplaces with WFA and FAA on their hands, forehead and shoes. All these allergens are also present in their cars, which International Journal of Occupational Safety and Ergonomics (JOSE) 245 prove that contaminants from work sources are transferred into the home environment and may be responsible for asthma episodes among family members. Potential sen sitization of bakers’ family members due to α-amylase associated clothes, shoes and other bakery textiles has been also reported by Vissers et al.[10]

Bibliography:

1. N. Upbringing of a preschool child: the development of an organized, independent, proactive, not sick, communicative, accurate. Growing healthy: software-based method. manual for preschool teachers. Moscow: Academy, 2003.198 p.
2. Baranov A.A., Kuchma.V.R., Snoblina N.A. - physical development of children and adolescents at the turn of the millennium, M. SCCH RAMS 2008. 216 pp.
3. Valina S.L., Ustinova O.Yu., Ivasheva Yu.A. Comparative assessment of the level of physical development of children attending preschool educational institutions with different occupancy. Perim 2006.
4. Manasova I.S., Kosimov Kh.O. Hygienic aspects of the possibility of using the new insecticide Seller in agriculture // International Journal of Psychosocial Rehabilitation. - 2020.- R. 336-342.
5. Manasova G.M., Zhumaeva Z.Zh., Manasova I.S. Epidemiological state of endocrine diseases. The role and place of innovative technologies in modern medicine // Proceedings of the 66th Annual Scientific and Practical Conference of the T.G. Abu Ali ibn Sino with international participation. November 23rd. 2018.- S. 169-170.
6. Manasova I.S., ACADEMICIA An International Multidisciplinary Research Journal. FEATURES OF LABOR OF WORKERS IN AGRO-INDUSTRIAL LABOR 10.5958 \ 2249-7137.2020.01622.5 .c.958-962.

7. Manasova I.S., ACADEMICIA An International Multidisciplinary Research Journal.ANALYSIS OF WORKING CONDITIONS BY PARAMETERS OF THE PHYSIOLOGICAL STATE OF WORKERS COTTON PLANT10.5958 / 2249-7137.2020.01634.1
8. Kasimov H.O., Manasova I.S., Nazarov S.E., Jumaeva Z.J., Nurova Z.H. Occupational hygiene in field farming // International Journal of Psychosocial Rehabilitation. Great Britain. - 2020. • - • No. 9.- P. 3830-3838.
9. MANASOVA I.S., Yadgarova Sh.S., Analysis of Indicators of Ghysical Development of Preschool children // CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES. Volume; 02 Issue; 02 / march-april 2021 ISSN; 2660-4159. 154-157.
10. MANASOVA I.S., Mansurova M.Kh., Youth's Look For A Healthy Lifestyle // CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES. Volume: 02 issue: 02 March – april2021 ISSN; 2660-4159.P.149-153.
11. MANASOVA I. S., Doktor Axborotnomasi. ANALYSIS OF STUDENTS ’OPINIONS ON THE BASIC COMPONENTS OF HEALTHY LIFESTYLE 2021, No. 1 (98) ISSN 2181-466X.
12. MANASOVA I .S., TIBBIYOTDA YANGI KUN Miya qon tomiridan keyin bemorlarni Reabilitatsiya qilish2 (34/1) 2021 ISSN 2181-712X