EP_433

2’-Fucosyllactose attenuates particulate matter -induced inflammation via inhibition of hypoxia-inducible factor in keratinocytes

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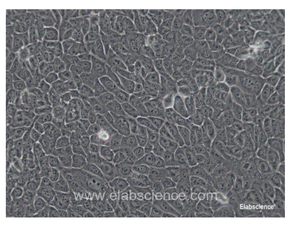
Introduction:

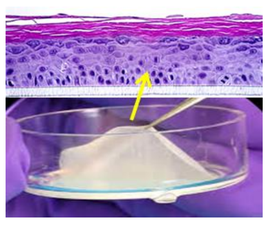
Particulate matter (PM) is known to induce oxidative stress via the production of reactive oxygen species (ROS) and to stimulate the secretion of pro-inflammatory cytokines, such as TNF-a, IL-1α, IL-6 and IL-8. In addition, these particles carry organic chemicals, such as polyaromatic hydrocarbons (PAHs), which are potent ligands for aryl hydrocarbon receptor (AhR) in keratinocytes. Activated AhR signaling causes inflammatory skin lesions similar to contact dermatitis.
2'-Fucosyllactose (2FL) is a major constituent of human milk oligosaccharides (HMOs), which can be present at ≤ 5 g/L in milk. It has been reported that a lower 2FL level in mother’s milk was associated with a higher incidence of diarrhea in breast-fed infants. In addition, 2FL possesses protective effects against infectious diseases, which are caused by pathogenic bacteria and their toxins. In the present study, we demonstrated the effects of PM_{10} on skin inflammation and HIF-1α accumulation. Furthermore, we investigated the inhibitory effects of 2FL on PM_{10}-induced HIF-1α accumulation via the PI3K/Akt pathway. Our results suggested that 2FL has protective effects against PM_{10}-induced inflammatory responses by inhibition of the PI3K/Akt signaling pathway in skin keratinocytes.

Materials & Methods:

- **Cell information**
  - Human epidermal keratinocyte cell line (HaCaT)
  - Epidermal skin (RHE, skinEthic®)
- **Fine dust, particulate matter**
  - PM_{10}-like (PAH’s)



<HaCaT cell line>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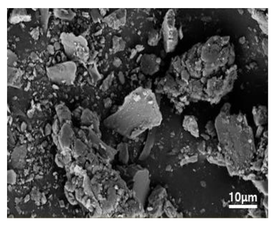
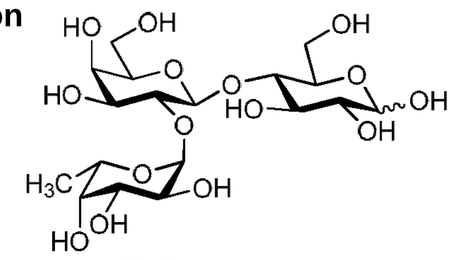


< Particulate matter >

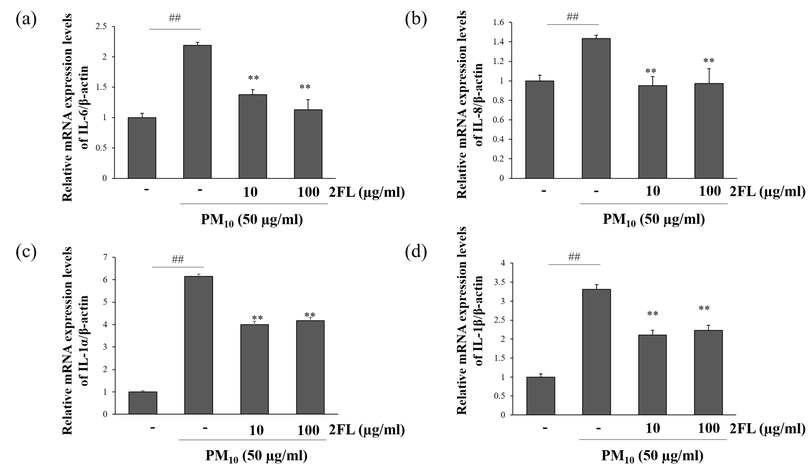
- **Evaluation of IL-6, IL-8, IL-1α and IL-1β**
  - Real time PCR
- **Evaluation of HIF-1 α and PI3K/Akt stabilization**
  - Western blotting
- **Evaluation of improvement of epidermis**
  - H&E staining
- **Material information**
  - 2´-fucosyllactose (2FL)



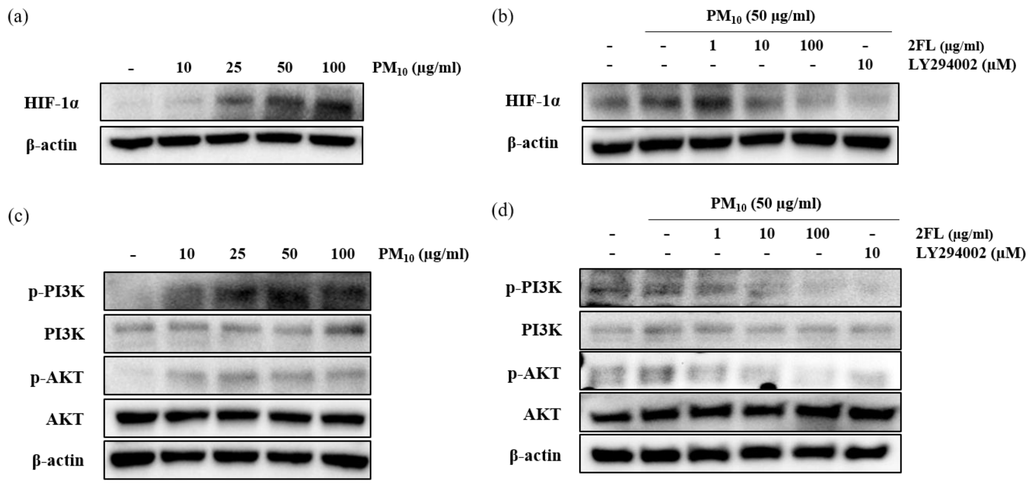
2’-Fucosyllactose

Results & Discussion:

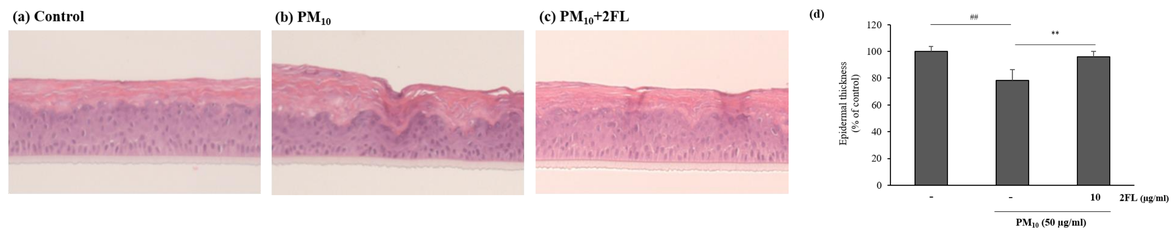
◆ Figure 1. The effects of 2FL on IL-6, IL-8, IL-1α and IL-1β mRNA expression levels in PM_{10}-induced HaCaT keratinocytes.



◆ Figure 2. The inhibitory effects of 2FL on the stabilization of HIF-1α and the PI3K/Akt pathway in PM_{10}-induced HaCaTkeratinocytes.



◆ Figure 3. Improvement of the PM_{10}-induced epidermal damage with treatment of 2FL in the RHE model.



Conclusions:

1.PM_{10} induced the mRNA expression of IL-6, IL-8, IL-1α, and IL-1β whereas 2FL treatment inhibited increase of pro-inflammatory cytokines in PM_{10}-induced HaCaT cells.
2.PM_{10} increased the protein levels of HIF-1α and 2FL suppressed of it by inhibiting the PI3K/Akt pathway in PM_{10}-induced HaCaT cells.
3.In addition, 2FL treatment also improved PM_{10}-induced epidermal thickness and integrity of the cornified layer in RHE model.
4.Taken together, we suggest that 2FL can be a potent candidate as a cosmetic ingredient to alleviate skin irritation and inflammation caused by urban air pollution.

References:

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