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# Ig Nobel Prize-winning episode: Trip from a slip on a banana peel to the mysterious world of mucus

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**Abstract**

Slip on a banana peel is not only a gag seed but also a genuinely tribological phenomenon. We measured the frictional coefficient under banana skin on floor material. The measured frictional coefficient was much lower than the value on common materials and similar one on well lubricated surfaces. Some deductions on mystery of organics were leaded from the similarity of gel function in banana peels and in articular joints. Every polymers are only synthesized by organisms. Furthermore, viscous materials are only formed by organic substances.


*Keywords:* Banana skin; Frictional coefficient; Follicle gel lubrication; Mystery of organics

## 1. Introduction

I became interested in analyzing the movement of stepping and slipping on a banana peel – a comic routine known throughout the world, from the viewpoint of friction, and conducted extensive experiments to examine its slipperiness. I examined the mechanism related to its slipperiness: when a banana peel is stepped on, a type of mucosal fluid is secreted as a lubricant. I also discussed the roles of mucus, which is generated only by organisms.

## 2. The road lead to a banana peel

In 1972, I chose "lubrication in joint prostheses" as the theme of my graduation thesis despite other engineering students' curious eyes. The literature that I have read first was a paper written by McCutchen (1962), which explained the slipperiness of synovial joints using the theory of weeping lubrication [1]. My encounter with this paper helped me conduct my research that received the Ig Nobel Prize 40 years later [2].

Weeping lubrication is a mechanism in which a fluid excreted from articular cartilages forms a lubricating film to increase the smoothness between the joints. I had been thinking that the mechanism of weeping lubrication resembled that of slipping on a banana peel. When writing books or papers, I chose the peels of bananas, from among many other things available in our daily lives, to explain the mechanism of weeping lubrication [3]. At that time, I thought that the results of experiments to examine the slippery characteristic of banana peels had already been published as it was a fact known to everyone. However, there were no scientific papers on the slippery characteristic of banana peels, although some previous studies were related to the peels: a practical example of the use of banana peels for the launch of ships to replace grease [4] and an ordinance issued by Cambridge City that slippery waste including banana peels must not be left on the streets [5].

Approximately 10 years ago, I became determined to analyze the characteristics of banana peels, because I thought I was responsible, as a researcher involved in bio-tribology, for conducting research that had not yet been implemented.

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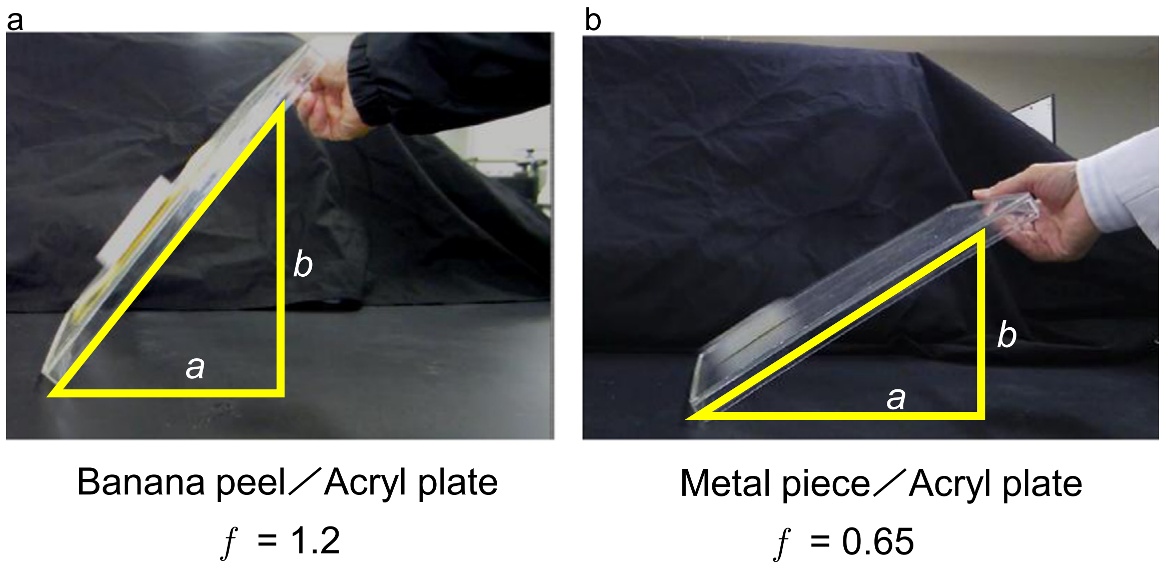


Fig. 1. The result of measurement of the angle of friction.

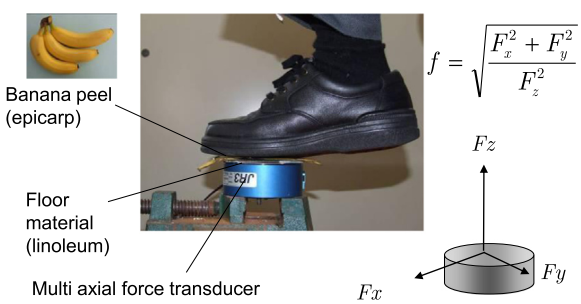


Fig. 2. A scene of friction measurement using a multiaxial load transducer. A banana peel placed on the sensors was stepped on.

## 3. Measurement of friction under a banana peel

If something is slippery, it means that its frictional coefficient is low. Therefore, you can objectively determine the difference in the slipperiness of two objects by comparing their frictional coefficients. I thought that I would easily find the answer by conducting an elementary physical experiment using banana peels, which were available to anyone.

In an experiment, I placed a banana peel on a slope, and determined the angle of the slope at which the peel started to slide down it – the angle of friction. The tangent of the angle of friction is the frictional coefficient. To my surprise, the measured angle of friction was greater than 45° (Fig. 1). In other words, the frictional coefficient was 1.0 or higher – a significantly large value. Considering that the frictional coefficient between the surface of a standard-type floor and shoe sole is approximately 0.4, it is reasonable to assume that an accident of slipping on a banana peel can rarely occur. Therefore, I had to reproduce the conditions required for people to slip on a banana peel, as explained in the preceding paragraphs.

To measure the frictional coefficient of a banana peel sliding on the floor, a person needed to step on it. However, stepping on a banana peel placed on a slope was dangerous and difficult.

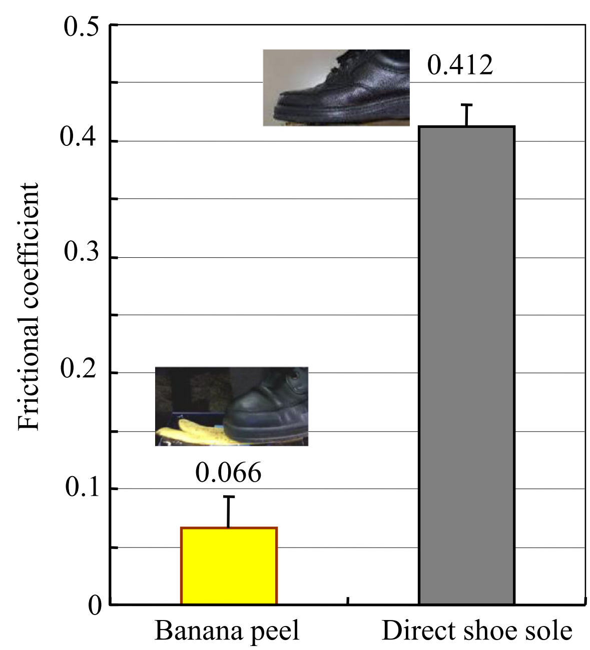


Fig. 3. Frictional coefficients under a banana peel [2].

Fortunately, there were a number of friction measurement devices introduced to examine the joint function in my laboratory. I thought that I would be able to measure the frictional coefficient of a banana peel while being stepped on, using those devices. I conducted the following experiment as presented in Fig. 2: I stepped on a banana peel placed on a floor board fixed on multiaxial load sensors, and measured both the normal and frictional forces.

## 4. Frictional coefficient under a banana peel

Whereas the frictional coefficient between the shoe sole and floor board was 0.412, the coefficient between the shoe sole