

**“Inverted power grip” is a sign of muscle weakness, help prevent frailty.
Possibility of Easily Identifying Muscle Weakness
by Opening Plastic Bottles Confirmed**

ITO EN, Ltd. (President: Daisuke Honjo; headquartered in Shibuya-ku, Tokyo), in collaboration with Kagoshima University Faculty of Medicine, has confirmed the possibility of easily identifying signs of muscle weakness in elderly people living in communities by evaluating their movements when opening PET bottles. The findings were published in an academic journal, *Geriatrics & Gerontology International*, on Monday, September 11.

According to the 2022 Comprehensive Survey of Living Conditions (conducted by the Ministry of Health, Labour and Welfare), the most common cause for those certified as requiring assistance under the Long-Term Care Insurance Act is “joint disorder” (19.3%), followed by “infirmity due to aging” (17.4%) and “bone fractures/falls” (16.1%)—where age-related “muscle weakness” can be considered one of the underlying causes for each of these top-ranking items. Since age-related “muscle weakness” is associated with the risk of harm to one’s health, including falls, fractures, hospitalization, and death, **it is important to recognize the signs of muscle weakness and address frailty*1 at an early stage, in order to extend healthy life expectancy in preparation for the era of 100-year life expectancy.**

In order to recognize the signs of muscle weakness at an early stage, ITO EN and Kagoshima University Faculty of Medicine conducted tests to validate whether the action of opening of PET bottles—which are in popular use worldwide—can be used to easily identify the signs of muscle weakness. It has already been reported that difficulty in opening plastic bottles is related to muscle weakness*2. Since the way of opening a plastic bottle varies from person to person, ITO EN and Kagoshima University Faculty of Medicine hypothesized that muscle weakness could be identified by the way in which a person opens a bottle. Based on this hypothesis, we investigated the relationship between muscle weakness and the way in which plastic bottles are opened scientifically, with a particular emphasis on the grip used to open the cap.

As a result, we found that opening a plastic bottle with an “Inverted power grip” is a useful sign of muscle weakness in the elderly. This suggested **the possibility that**, in addition to “feeling difficulty in opening a plastic bottle,” **signs of muscle weakness could be easily identified by evaluating the opening movement pattern (whether a person uses an “Inverted power grip” or not).**



In the future, we intend to contribute to the prevention of frailty for healthy longevity through our beverage products by recommending the evaluation of plastic bottle-opening movement patterns (whether a person uses an “Inverted power grip” or not) as an easy way to identify signs of muscle weakness. As a Health Creation Company, we will contribute to creating healthy and fulfilling lifestyles for customers and a sustainable society from many perspectives, from our beverages to how customers open our products.

○ Test method

In the 2021 Tarumizu Study, a cohort study was conducted on 336 senior adults aged 65 years or older living in the community (average age 74.6 ± 5.9 years, 58.3% women).

Participants were asked to open an unopened PET bottle product (Oi Ocha Green Tea, 525 ml PET bottle) in the usual way while seated, and their opening behavior was observed and classified into four patterns of cap grip: Lateral pinch grip, Inverted power grip, Normal power grip, and Three fingers pinch grip. As a result, it was found that 248 participants (73.8%) used “side belly grip,” 55 (16.4%) used “Inverted power grip,” 20 (6.0%) used “Normal power grip,” and 13 (3.9%) used “three-finger grip”. Next, muscle strength was measured by measuring the maximum grip strength of the dominant hand, with the first quartile value (27.8 kg for males and 18.4 kg for females) as the cutoff value^{*3} for each gender, with “muscle weakness” defined as muscle strength below the cutoff value.

Logistic regression analysis^{*4} of these results showed a significant relationship between “Inverted power grip” and muscle weakness compared to “Lateral pinch grip.” This suggests that opening PET bottles with an “Inverted power grip” is associated with muscle weakness in elderly people living in the community, confirming a relationship between muscle weakness and the pattern of PET bottle-opening movements. On the other hand, no significant relationship was found for “Normal power grip” and “three-finger grip.”

*1 A weakening of the mind and body due to aging. It is a condition that falls between a “healthy” state and a state requiring long-term care, where there is a decline in physical and cognitive functions. With appropriate treatment and prevention, it may not progress to a state requiring long-term care.

*2 Geriatr Gerontol Int, 2022; 22: 682–684.

*3 A value that separates groups with a particular illness, disease, or condition from those without. In this study, the cutoff values for the maximum grip strength of the dominant hand (27.8 kg for males and 18.4 kg for females) were set as the first quartile values (values at the 25th percentile counting from zero) when the data were ordered in ascending order.

*4 A method to predict the probability of occurrence of the objective variable from the explanatory variables.