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### **Movements of the trunk and pelvis in forward bending and returning**

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Forward bending and returning are frequently practiced in daily life, and often regarded as responsible for the low back pain. While these motions are achieved with a coordinated action of the trunk and pelvis, movements in each of these segments and their inter-relations have not been fully clarified. To elucidate these points, we took video-images of 5 young male subjects from the side while they bent forward deeply from an upright position and returned to upright again in 10 seconds. Landmarks were put on the cervicale (C7), anterior-superior iliac spine (Is), trochanterion (Tr), and spinous process of the first sacral vertebra (S1). From the video images, the following lines and angles were defined; line L combining C7 and Tr; line M combining Is and S1; bending angle  $\theta_1$  and pelvic angle  $\theta_2$  as an increase in the inclination of line L and line M, respectively, with forward bending; torso angle  $\theta_3 = \theta_1 - \theta_2$ . Changes of  $\theta_1$ ,  $\theta_2$ , and  $\theta_3$  were examined from the beginning of bending to the end of returning.

The results were as follows: 1) Proceedings of the bending angle were extremely fluent in all subjects, though the maximum angle varied between 80 and 120 degrees across subjects. 2) By contrast, torso angle and pelvic angle changed more or less stepwise. 3) The bending angle and pelvic angle maximized almost synchronously in all subjects. 4) Angular excursions were larger in the torso angle than in the pelvic angle in 3 of 5 subjects, and vice versa in the others. 5) The pelvis preceded the torso in the initial stage of returning from the maximum bending in 2 subjects.

Our investigation has shown that the forward bending and returning movements as a whole proceed with a remarkable smoothness, with the least differences between individuals. In contrast, the torso and pelvis move fairly stepwise supplementing each other, though with a considerable individual difference. It has also disclosed that the pelvic rotation does not necessarily precede the spinal extension, as generally believed.

### **Is the ball speed affected by the reaction swing for hitting of baseball?**

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This study examined the differences between four batting manners; normal swing (N), full swing (F), hitched swing (H), and reaction swing (R). A ball was placed on a batting tee and subjects hit the ball randomly by the four batting manners mentioned above. Each subject swung 5 times for each type of the batting manners. The subjects were 52 male university baseball players with 12.52 years

career. Means of their body height and weight were 173.63 cm and 69.63 kg, respectively.

Means and standard deviations of the four maximal ball speeds hit by N, F, H and R swings were  $127.81 \pm 7.08$ ,  $127.99 \pm 6.48$ ,  $129.72 \pm 6.63$ ,  $130.02 \pm 7.47$  km/h, respectively. The ball speeds hit by R and H swings were significantly higher than those by N and F swings ( $p < 0.001$ ). The differences of ball speeds were not significant between N and F swings, and between H and R swings.

These tendencies were prevalent in the subjects with higher level of batting skills, but not identified in those with lower level of batting skills. These results suggest that the subjects with higher level of the batting skills have more possibility of improving the batting manners.

### **Is Seita-fitting really comfortable? Part 2: Electromyographic study of different load-supporting points**

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Seita is a traditional carrier frame for back packing used in Nishiki-cho, Yamaguchi Prefecture, Japan. In this place, all the people have their own seitas which are made for themselves to carry loads as easily as possible. Our previous study suggested that people in Nishiki-cho support the load not on lumbar vertebrae (OLV) but on sacrum (OS) in carrying loads with seitas. We define fitting to support loads on sacrum as seita-fitting. The purpose of this study was to verify the effects of the difference between the two load-supporting conditions, i.e., OLV and OS conditions, on heart rate, oxygen uptake, and muscle activities.

Nine physically fit males ( $26.7 \pm 3.1$  years old), each carrying a 8 kg carrier frame and a 40 kg load, walked on a treadmill at a speed of 50 m/min. EMGs were recorded from the trapezius, rectus abdominis, erector spinae, vastus lateralis, rectus femoris, vastus medialis, biceps femoris (long head), tibialis anterior, soleus, gastrocnemius (medial and lateral head) muscles, all taken from the right side of the body. For each subject, the integrated EMG (IEMG) was normalized by dividing the IEMG both under OLV and OS conditions by the IEMG under no load condition for each muscle investigated.

The following measurements were significantly higher under OLV than under OS condition; oxygen uptake and IEMGs of the tibialis anterior, soleus, and gastrocnemius (medial head) muscles. However IEMG of the erector spinae muscle was significantly lower under OLV than under OS condition. These results suggest that seita-fitting decreases the muscle activities in the lower limb, which in turn causes to decrease oxygen uptake, canceling out its increase due to the erector spinae activity. Considering the results of the IEMG in the lower limb, supporting loads on sacrum appears to make the activity of the driving and antigravity muscles lower.

These data lead to the conclusion that carrying loads with Seita is more efficient and comfortable if supported on sacrum than on lumbar vertebra.

### **Changes of surface EMG during simulated mushroom picking**

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Surface electromyogram (EMG) was examined to evaluate muscle strain during simulated mushroom picking. Mushroom picking was simulated by picking corks from a horizontal plane at a height of the elbow. The picking frequency was 20 times in a minute and two corks were picked up for each

time. Static contractions were also performed to record EMG during non-working period by keeping the shoulder abduction and a stooping posture. The contractions were kept for one minute for each posture, which were called as test contractions.

The experiment consisted of a series of a 60-minute rest, three times of a 20-minute work (W1, W2, W3), a 30-minute rest, a 20-minute work (W4), a 30-minute rest, and a 20-minute work (W5). In W4, corks were picked up from a closer half of the area to lighten the workload. The test contractions were performed just before and after the works, and at every 10 minutes in rest periods. Surface bipolar EMGs were recorded from the right side of trapezius, infraspinatus, deltoid and both sides of elector spinae muscles. Fatigue sensations were evaluated with Borg's scale around the shoulder, neck, and low back for every 30 seconds during test contractions and for every five minutes during works. Amplitude of EMG (AEMG) relative to the maximum voluntary contraction and mean power frequency (MPF) of EMG were calculated. Subjects were 9 females.

Fatigue sensations developed during W1, W2 and W3, and did not return completely to the state before W1 in the subsequent rests. EMGs from the neck and shoulder muscles in the test contractions changed similarly with the fatigue sensation, i.e. AEMG increased and MPF decreased during W1, W2, and W3, and they also did not return completely. The changes of EMG during work were not related with fatigue sensations. The changes of EMG did not reflect the difference in the degree of fatigue sensations between subjects except for MPF of the infraspinatus muscle. MPF of the elector spinae muscle was higher during the works than during the test contractions. The differences were limited in EMG between W4 and other works.

From these results, it was concluded that surface EMG reflects fatigue sensation roughly, but not precisely and the strain of mushroom picking was relatively light for the elector spinae but not easy for the infraspinatus muscle.

## **The problem of applying BMI**

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The Body Mass Index (BMI) was fixed at 22 as a standard value at the 10th meeting of Japan Corpulence Academy in 1989. The reasons were that, first, the number of patients suffering from various kinds of disease was the least at 22.2 of BMI in the medical examination survey of 3,500 male local public service workers, and second, BMI was closely correlated with the percent body fat. Later, some members of the Japan Academy of Life Insurance Medicine reported that the BMI at which the death number case and the disease hospitalization was the lowest varied with sex and age from 19.7 to 24.3.

I examined the relationships between BMI and the percent body fat on the basis of the data obtained from students in Fukuoka University of Education. As a result, the coefficient of correlation with the percent fat was similar in the Quetelet index and BMI, while a little lower in the Rhorer index. Regarding the influence of age, BMI increased throughout the growing period after childhood, corresponding to an increase in body height. As for the student data, however, BMI had no correlations with body height, and if we understand it based on the dimension theory, both the proportion model and the elastic model were not validated. In the adulthood, BMI increased with age until fifties. Concerning the time-related changes, BMI increased with time, except in the young women, toward the present.

### **Transition of the concept of health and policy of health promotion in Japan since Meiji Era: With a special focus on the changes of health examinations and health contests for school children**

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To examine the influence of health concepts transition on health care activities in Japan, changes of the school health examination system and pupil's health contest system were investigated. The first pupil's health contest was held in 1930 in Japan. The purpose of the contest was to establish a concrete and visible health concept to provide health education for getting such health conditions, and to develop nation-wide consensus on the importance of health promotion.

The concept of health proposed through the health contests has changed over time. When the pupil's health contest started, only the physical health aspect was included in the concept. After the World War II, harmony of mind, body, and social nature became important contents of the health. The purpose of health promotion also changed from the improvement of physical features and strength to the maintenance and improvement of the quality of life. Until the end of World War II, improving and maintaining health was an obligation for the citizens to support the nation's economical and military activities, but it has been considered as a citizen's right since the end of World War II.

According to the changes of the concept of health, the school health examination system has also changed in Japan. The school health examination system was proposed in 1880 for the first time. The purpose of the health examination was to collect scientific health data of school children, and at the same time, to allow them to acknowledge their own health conditions and to urge them to take action to pursue the ideal health image. Although mental and social aspects were introduced into the concept of health, corresponding items to be checked have not been added to the school health examination. Through the above-mentioned investigation, it is suggested that the change of health concepts have much influence on health care activities in Japan.

### **Changes of culture and ecosystem, and demographic trends in the modern Ainu society**

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Ainu are the indigenous people in Hokkaido, Japan. After the Meiji Restoration in 1867, Ainu were forced to abandon their traditional culture and ecological relationships. The main change was a transition in subsistence from hunting-gathering to farming. The Japanese Government's colonial program for Hokkaido forced Ainu to take up agriculture, and with the assimilation program for Ainu, acculturation with Wajin (non-Ainu Japanese in Hokkaido) proceeded and a new demographic phenomenon emerged: intermarriage between Ainu and Wajin. These changes influenced the population dynamics of Ainu in their local villages after the Meiji Restoration. The aim of this study is to examine the relationships between acculturation and demographic trends of the modern Ainu society.

The demographic trends and acculturation of a local Ainu village in Hidaka District were investigated. The changes in culture and ecosystem of Ainu society after the Meiji Restoration were reflected in the population decrease during 40 years (1887-1927), due to a high mortality caused by epidemic disease and malnutrition, and the emigration to the coastal regions for fishing. The extremely high death rate was characterized by frequent death among people under 40 years of age, those who might otherwise contribute most to biological reproduction and transmission of the traditional culture.

From 1927 onward, the population turned to increase by virtue of the lowering of mortality and

rather high fertility. Inter-marriage between Ainu and Wajin increased remarkably, and population became more mixed. Adoption prevailed owing to the parent's death and poverty in both Ainu and Wajin families who failed in the settling. The Ainu villages changed from its traditional form to the collective villages. The private landownership of Ainu was established in 1899 based on the Rule of Kyudojin Hogohou, with the transfer of the land being prohibited except in the case of inheritance. Therefore, most Ainu stayed in the land (village) before the World War II.

After the War, with the Japanese Government Program for the Ainu (the Agrarian Reform and relaxation of restriction of the transfer of the land), the economic condition of the Hidaka District (the prevalence of breeding racing horses of most pastures), and diversification of the occupation in Ainu, most Ainu began to sell their lands for such pastures, and left their villages to get a position in town. After the 1970's the tendency was accelerated, and consequently most Ainu villages changed drastically.