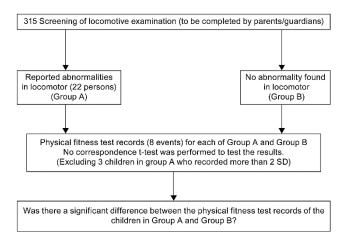
Appendix 1. Reference material of "Questionnaire on locomotorium (spine/thorax, extremity, bone joint)" used in Osaka Prefecture

Reference material for the locomotive questionnaire (spine/thorax, extremity, bone, joint) III. Please use this when answering the questions (this is meant only as a reference)

| | III. Please use this when answering the qu | uestions (this is meant only as a reference) |
|---|--|---|
| 2 | There is pain when bending or warping the waist % If you have pain, please visit a medical | Four checkpoints ① There is a difference in height between the left and right shoulders. ② There is a difference in the lines of the left and right sides. ③ There is a difference in height and position of the left and right shoulder blades. ④ When the waist is bent, there is a difference in the heights of the left and right back sides. ※ If any of these are true, or if you are in doubt, please check □ ▷ I have pain when I bend my back and move my body forward. |
| | institution immediately. Do not wait for an examination at school | ➤ There is a pain when relaxing my body and leaning back. ※ If either of these is true, please check □ |
| 3 | I have pain when I move my arms and legs X If you have pain, please visit a medical institution immediately. Do not wait for an examination at school | □ I have pain when I place my hands forward, turn my palms upward and bend or stretch my elbows (left or right) □ I have pain when I raise my hands straight and move my arms up to my ears. □ I have pain in the hip joints, knees and ankles when I try to place my hands forward and crouch ※ Please check □ if any of these is true. |
| 4 | Trouble moving arms and legs | My elbow does not completely bend and does not fully extend when my hands are placed forward, my palms are facing up and my elbows are bent or stretched. When both hands are stretched straight upward and I am trying to move my arms to my ears, both arms do not meet the ears or the head is bent. When putting the hands forward and squatting, the hip joints, knees and ankles cannot bend and canot be touched X If any of these is true, or if you are in doubt, please check |
| 5 | One leg standing cannot be more than 5 seconds | Is it possible or impossible to stand on one foot for 5 seconds without tilting or staggering the body? |
| 6 | Cannot squat | I cannot completely crouch by putting the soles of my feet on the floor and spread my legs to shoulder width. However, if you can completely crouch but fall backward immediately, please check |

Appendix 2. Experimental protocol



Appendix 3. Number of Children with Reported Symptoms in the Locomotive Disorder Screening by Grade (2022, Unit: Children).

| Number reported in the screening | 3rd grade | 4th grade | 5th grade | 6th grade | Total |
|---|--------------|-----------|--------------|--------------|-----------|
| 1. Bend in the spine (including scoliosis) | 1 | 3 | 1 | 1 | 6 |
| 2. Pain when bending or arching the lower back | | | | | 0 |
| 3. Pain when moving the arms or legs | 1 | | | | 1 |
| 4. Poor movement in parts of the arms or legs | | 1 | | | 1 |
| 5. Inability to stand on one leg for more than five seconds | | 2 | | | 2 |
| 6. Inability to crouch down | 1 | 3 | 1 | 4 | 9 |
| 7. Unknown | | | | | 0 |
| 8. Combination of the above items (e.g., 5 and 6) | 1 | | 1 | 1 | 3 |
| Total (percentage of grade) | 4 (5.3%) | 9 (11.3%) | 3 (3.6%) | 6 (7.9%) | 22 (7.0%) |

Appendix 4. Records of Physical Fitness Test of Participants in 2022 for School B (3rd-6th Grade).

| Gra de | Bo ys | Grip strengt (kg) | h | Sit-ups (times) | | Seated forward (cm) | bend | Side-st (times | • | 20-m run (tir | | 50-m (secon | run ds) | Standin jump (c | | Softba throw | |
|------------|----------|-------------------------|------------------|--------------------|------------------|---------------------------|------|---------------------|--------------------|--------------------|------------|--------------------|-------------------------|----------------------|------------|-------------------|----------------|
| | | Avera | S | Avera | S | Avera | SD | Aver | S | Avera | SD | Aver | SD | Avera | SD | Aver | SD |
| | | ge | D | ge | D | ge | | age | D | ge | | age | | ge | | age | |
| 3rd | | 10.9 | 2 | 15.1 | 7 | 26.7 | 6.9 | 31.9 | 7. 1 | 25.8 | 16.8 | 10.2 | 1.0 | 135.7 | 19.4 | 12.2 | 5. 9 |
| | | | 7 | | 0 | | | | | | | | | | | | |
| 4th | | 13.3 | 3 | 17.5 | 6 | 28.6 | 6.1 | 33.6 | 7. | 27.6 | 13.0 | 10.1 | 1.2 | 137.8 | 24.5 | 15.1 | 5. |
| | | | 4 | | 7 | | | | 1 | | | | | | | | 9 |
| 5th | | 14.5 | 3 | 18.1 | 6 | 29.6 | 6.9 | 38 | 7. 9 | 43.4 | 21.2 | 9.9 | 3.4 | 153.9 | 27.7 | 21.6 | 10 |
| | | | 8 | | 6 | | | | 9 | | | | | | | | .0 |
| 6th | | 18.8 | 4 | 18.9 | 6 | 28.5 | 8.9 | 46.2 | 6. | 49.1 | 23.7 | 9.2 | 1.2 | 159.7 | 20.7 | 24.3 | 10 |
| | | | 6 | | 1 | | | | 6 | | | | | | | | .6 |
| Gra | Gi | Grip | | Sit-ups | | Seated | | Side-st | tep | 20-m | shuttle | 50-m | run | Standin | g long | Softba | ıll |
| de | rls | strengt (kg) | h | (times) | | forward (cm) | bend | (times |) | run (tiı | mes) | (secon | ds) | jump (c | m) | throw | (m) |
| | | Avera | S | Avera | S | Avera | SD | Aver | S | | | | | | | Aver | SD |
| | | ge | D | | | | | AVCI | 3 | Avera | SD | Avera | S | Avera | SD | Avei | |
| 3rd | | | U | ge | D | ge | | age | D | Avera ge | SD | Avera ge | S D | Avera ge | SD | age | |
| | | 9.2 | 1 | ge 13.3 | D 5 | ge 30.5 | 6.6 | | D 5. | | SD 10.7 | | D 0. | | SD 15.4 | | 2. |
| | | 9.2 | 1 | | 5 | _ | 6.6 | age | D | ge | | ge | D | ge | | age | 2. 1 |
| 4th | | 9.2 | | | | _ | 7.6 | age | D 5. | ge | | ge | D 0. | ge | | age | |
| 4th | | | 1 9 | 13.3 | 5 0 | 30.5 | | age 29.8 | D 5. 4 | ge 19.4 | 10.7 | ge 10.6 | D 0. 8 | ge 119.7 | 15.4 | age 7.4 | 1 |
| 4th | | | 1 9 | 13.3 | 5 0 | 30.5 | | age 29.8 | D 5. 4 | ge 19.4 | 10.7 | ge 10.6 | D 0. 8 | ge 119.7 | 15.4 | age 7.4 | 3. |
| 4th 5th | | | 1 9 2 | 13.3 | 5 0 6 | 30.5 | | age 29.8 | 5. 4 5. 9 | ge 19.4 | 10.7 | ge 10.6 | D 0. 8 1. 3 | ge 119.7 | 15.4 | age 7.4 | 3. 3. 5. |
| | | 12.2 | 1 9 2 6 | 13.3 | 5 0 6 | 30.5 | 7.6 | age 29.8 32.2 | 5. 4 | ge 19.4 22.7 | 10.7 | ge 10.6 10.4 | D 0. 8 | ge 119.7 133.8 | 15.4 | age 7.4 9.5 | 3. 3 |
| | | 12.2 | 1 9 2 6 | 13.3 | 5 0 6 6 | 30.5 | 7.6 | age 29.8 32.2 | 5. 4 5. 9 | ge 19.4 22.7 | 10.7 | ge 10.6 10.4 | D 0. 8 1. 3 | ge 119.7 133.8 | 15.4 | age 7.4 9.5 | 3. 3. 5. |

Appendix 5. Results of the T-test Between the Group in which Parents Reported that their Child's Locomotive Condition was Abnormal in the Locomotive Examination and the Group in which there was no Abnormality (by Grade, Sport, and Sex) (Detailed version).

| Gra | Boy | Grip st | rength | | Sit-ups | | | Trunk for | ward flex | ion | 510 | le-step | |
|----------------------------|-----------|-----------------------------|---|---|----------------------------------|--|--|--|--|--|--|--|--|
| de | S | P- valu e | screen ing submi tter | healthy person | P- value | screenin g submitte r | healt hy pers on | P-value | screeni submit | - | val rs e | | hy |
| 3rd | | P < 0.01 | 8.25 | 11.15 | P < 0.001 | 5.7 | 16.03 | 0.1696 | 23.5 | 27. 5 | .0 0.1 47 | | 32.2 |
| 4th | | 0.27 29 | 12.4 | 13.42 | P < 0.01 | 11.2 | 18.45 | P < 0.01 | 25.4 | 29 6 | .0 P 0.0 | | 34.45 |
| 5th | | P < 0.05 | 13 | 14.57 | 0.6286 | 19.33 | 18 | 0.5067 | 29.67 | 29 | .6 0.7 01 | | 37.83 |
| 6th | | 0.98 62 | 22.5 | 17.93 | 0.2782 | 17.5 | 19.2 | 0.7692 | 31 | 27. 3 | .9 0.3 77 | | 46.3 |
| Gra | Boy | 20-m s | huttle run | | 50-m run | | | Standing | long jum | | So | ftball throw | |
| de | S | P- valu e | scree ning submi tter | healthy person | P- value | screenin g submitte r | healt hy pers on | P-value | screeni submit | - | val rs e | | hy |
| 3rd | | 0.35 75 | 22.33 | 26.1 | P < 0.01 | 11.35 | 10 | 0.1935 | 127.5 | 13 5 | 6. 0.7 38 | | 12 |
| 4th | | 0.15 13 | 21.8 | 28.42 | P < 0.05 | 10.9 | 9.98 | P < 0.001 | 116.2 | 14 03 | 1. P 0.0 | | 15.7 |
| 5th | | 0.25 95 | 47.5 | 43.15 | 0.3659 | 9.27 | 9.98 | 0.500 | 173.33 | 15 44 | | | 21.85 |
| 6th | | 0.30 47 | 44.5 | 50.14 | 0.2164 | 9.57 | 9.13 | P < 0.01 | 140.8 | 16: 35 | | | 23.38 |
| | | | | | | | | | | | | | |
| | Girl | Grip st | trength | | Sit-up: | s | | Trunk fo | orward fle | xion | Side-st | tep | |
| | Girl s | Grip st | trength screenin g submitte r | у | Sit-up: P- value | screeni ng submitt er | health y perso n | Trunk fo P- valu e | orward fle screen ing submi tter | xion health y person | Side-st P- value | screeni ng submi tter | healthy person |
| de | | P- | screenin g submitte | y e perso | P- | screeni ng submitt | y perso | P- valu | screen ing submi | health y | P- | screeni ng submi | |
| de 3rd | | P- | screenin g submitte | y e perso n | P- | screeni ng submitt er | y perso n | P- valu | screen ing submi tter | health y person | P- | screeni ng submi tter | person |
| | | P- value | screenin g submitte r — | y perso n 9.16 | P- value | screeni ng submitt er | y perso n 13.27 | P- valu e | screen ing submi tter | health y person | P- value | screeni ng submi tter | person 29.77 |
| de 3rd 4th 5th | S | P- value 0.128 1 | screening submitte r | y perso n 9.16 12.31 | P- value 0.25 05 | screeni ng submitt er 12.5 | y perso n 13.27 14.89 | P- valu e | screen ing submi tter 29.25 | health y person 30.5 32.69 35.69 37.71 | P- value | screeni ng submi tter 30.25 | 29.77 32.39 35.55 |
| 3rd 4th 5th 6th | S | P- value 0.128 1 20-m s | screening submitte r | y perso n 9.16 12.31 14.22 18.89 | P- value | screeni ng submitt er — 12.5 — | y perso n 13.27 14.89 15.75 22.13 | P-valu e 0.20 37 Standing | screen ing submi tter 29.25 g long jun | health y person 30.5 32.69 35.69 37.71 | P-value 0.248 1 Softba | screeni ng submi tter 30.25 Il throw | 29.77 32.39 35.55 40.1 |
| 3rd 4th 5th 6th Gra | S | P-value 0.128 1 | screening submitter | y perso n 9.16 12.31 14.22 18.89 health y perso n | P- value 0.25 05 50-m i | screeni ng submitt er | y perso n 13.27 14.89 15.75 22.13 health y perso n | P-valu e 0.20 37 — Standing P-value | screen ing submi tter 29.25 g long jun screeni ng submi tter | health y person 30.5 32.69 35.69 37.71 | P-value 0.248 1 Softba P-value | screeni ng submi tter 30.25 Il throw screeni ng submi tter | 29.77 32.39 35.55 40.1 healthy person |
| 3rd 4th 5th 6th Gra de | S | P-value 0.128 1 | screening submitter 10.75 | y perso n 9.16 12.31 14.22 18.89 health y perso n 19.45 | P-value 0.25 05 50-m r P-value | screeni ng submitt er | y perso n 13.27 14.89 15.75 22.13 health y perso n 10.57 | P-valu e 0.20 37 Standing P-value | screen ing submi tter 29.25 g long jun screeni ng submi tter | health y person 30.5 32.69 35.69 37.71 healt hy perso n 119.6 7 | P-value 0.248 1 Softba P-value | screeni ng submi tter 30.25 Il throw screeni ng submi tter | 29.77 32.39 35.55 40.1 healthy person |
| 3rd 4th 5th 6th Gra de | S | P-value 0.128 1 | screening submitter | y perso n 9.16 12.31 14.22 18.89 health y perso n | P- value 0.25 05 50-m i | screeni ng submitt er | y perso n 13.27 14.89 15.75 22.13 health y perso n | P-valu e 0.20 37 — Standing P-value | screen ing submi tter 29.25 g long jun screeni ng submi tter | health y person 30.5 32.69 35.69 37.71 healt hy perso n 119.6 | P-value 0.248 1 Softba P-value | screeni ng submi tter 30.25 Il throw screeni ng submi tter | 29.77 32.39 35.55 40.1 healthy person |
| 3rd 4th 5th 6th | S | P-value 0.128 1 | screening submitter 10.75 | y perso n 9.16 12.31 14.22 18.89 health y perso n 19.45 | P-value 0.25 05 50-m r P-value | screeni ng submitt er | y perso n 13.27 14.89 15.75 22.13 health y perso n 10.57 | P-value 0.20 37 Standing P-value 0.218 | screen ing submi tter 29.25 g long jun screeni ng submi tter | health y person 30.5 32.69 35.69 37.71 healt hy perso n 119.6 7 134.4 | P- value 0.248 1 Softba P- value 0.435 | screeni ng submi tter 30.25 Il throw screeni ng submi tter | 29.77 32.39 35.55 40.1 healthy person |