IP-14

HANDGRIP FORCES, LOAD CARRIAGE AND TRAINABILITY: CAN ELITE FEMALE ATHLETES COMPETE WITH THE AVERAGE MAN?

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Even in our highly technological society, manual lifting and carrying of loads are still common types of exercise in everyday life. The ability to carry heavy loads often depends on handgrip strength. Physically demanding strength efforts occur during household and leisure time activities as well as in various occupational tasks. Thus, handgrip strength is of highly practical importance not only for seniors and women (e.g. carrying shopping bags, bottle crates) and in some sports (judo, climbing, handball etc.) but also for physically hard working employees (e.g. craftsmen, firefighters, military service). In this context transporting a casualty on a stretcher is a prime example for challenging occupational handgrip strains.

The present article is a review of our previous studies focusing on 1) maximal manual stretcher carriage of ambulance workers (17 men/15 women) and 2) handgrip strength of more than 2000 healthy adults. Aims of our studies were (i) to quantify transport performance and grip force recovery, (ii) to establish epidemiologically relevant normative handgrip strength data, (iii) to assess the influence of gender and to estimate maximal trainability of women by comparing data of young adults with highly trained female athletes.

METHODS: Stretcher carriage tests were performed on a treadmill with a velocity of 4.5 km/h. Using both hands for transport, the volunteers had to carry a loaded stretcher –mock-up until exhaustion. Mean load measured at the front handles was some 245 N (25 kg) on each side. Isometric handgrip strength was measured over 15 s using a handheld handgrip ergometer. Maximal (Fmax) and mean handgrip force (Fmean) were derived from the 15 s force tracings.

RESULTS/DISCUSSION:

1) Performance of male and female ambulance workers

Maximal stretcher transport time of men (184 s) was almost double the time of women (98 s). Immediately after the exhausting transport, maximal handgrip strength was decreased by 25 % (men) and 14 % (women). Irrespective of gender, complete recovery of handgrip strength required up to 72 h. Eccentric strains probably caused by vertical movements of the stretcher led to muscle damages and explain the slow force recovery.

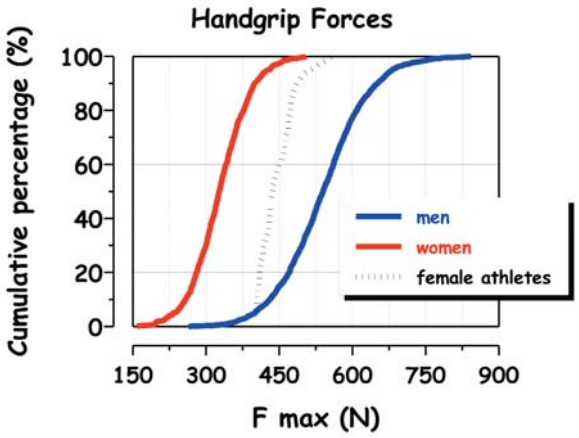

Figure: Distribution of maximal handgrip forces (Fmax) of young men (n=1654), women (n=533) and highly strength trained female elite athletes (n=65)

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2) Handgrip strength of young men, women and highly strength trained female athletes
As expected, Fmax (men: 541 N; women: 329 N) and Fmean (men: 461 N; women: 278 N) differed significantly between both sexes. However, a first surprise was the gender related distribution (see Figure) showing only a small overlap: 90 % of the women did not even surpass the maximal handgrip strength of the 5th percentile (398 N) of male volunteers. The female elite athletes (all volunteers were members of the German national teams in Judo and Handball) were considerably stronger (Fmax: 444 N; Fmean: 375 N) than their female counterparts. However, it was another surprise that these values did not even reach the 15th percentile of our cross-sectional male control group. These findings strongly indicate that the strength level of women attainable by longtime and intensive training will not even approximately reach the strength level of an average man.

LITERATURE:

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Invited Presentations

IP-15

PHYSICAL TRAINING IN SOLDIERS INVOLVED IN MODERN MILITARY CONFLICTS: PHYSICAL FITNESS FROM NEW RECRUITS TO WARFIGHTERS DEPLOYED ON A BATTLEFIELD

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During the 25 last year's military operations have been profoundly modified in terms of duration, intensity and specificity. Warfighters involved in modern military conflicts have to deal with different physical requirements during deployment (e.g., load carriage patrolling, convoys, preparing forward operating camps, lifting and carrying equipment) implying a good physical fitness.

To prepare a warfighter for the physically demanding tasks performed during military operations, the army physical training is now designed with a modern approach combining endurance and resistance training sessions. This approach needs a periodization of training both to prevent injury and to limit overtraining syndromes development. Because physical training is a basic of soldier profession, we have also to consider a periodization of training through the soldier career from his initial military training to his specialization in a regiment.

To illustrate the evolution of army physical training among different experienced soldiers populations, few results will be presented concerning:
– the physical fitness of new recruits from French alpine troops before and after their initial military training,
– the physical fitness of warfighters from French alpine troops during a deployment on a battlefield.
Endurance capacity, muscular strength, military abilities and injuries occurrence depending on both training program and soldiers experience will be discussed.

Invited Presentations