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Editorial

The "*Journal of Functional Morphology and Kinesiology*" Journal Club Series: Highlights on Recent Papers in Physical Activity and Sedentary Behavior

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Abstract: We are glad to introduce the sixth Journal Club. This edition is focused on several relevant studies published in the last years in the field of physical activity and sedentary behavior, chosen by our Editorial Board members and their colleagues. We hope to stimulate your curiosity in this field and to share with you the passion for the sport seen also from the scientific point of view. The Editorial Board members wish you an inspiring lecture.

1. Introduction

Last century, Prof. Mayer [1] noted the importance of physical inactivity in the etiology of obesity. Malnutrition is one of the gravest threats in public health in both developing and developed countries. The nutritional aspects associated with physical activity are fundamental in daily life. In fact, inactivity might play an important role in the development of obesity and several chronic diseases [2]. Low sessions of physical activity and large amounts of inactivity or sedentary behavior are widely assumed to be causally involved in the etiology of obesity and underlie public health messages globally. Key non-nutrition prevention targets are increases in physical activity and reductions in time spent in sedentary behavior [3]. Different researchers have evaluated the impact of increased physical activity or decreased sedentary behavior as part of multifactorial interventions on prevention of weight/fat gains or remission of obesity in clinical and community-based settings, with interesting results [4]. Decreasing sedentary behavior yielded significant results, providing experimental evidence that sedentary behavior is causally linked to being overweight [5]. Current evidence suggests that regular exercise can be beneficial both physically and psychologically and has great importance in maintaining good health and reducing drastically comorbidity and pain; indeed, inactivity is a risk factor for several chronic diseases. Moreover, physical activity is a good way to socialize and an excellent anti-stress agent, not to mention the aesthetic benefits for our bodies [6].

2. Recent Papers Regarding Physical Activity and Sedentary Behavior

2.1. Apps to Improve Diet, Physical Activity and Sedentary Behavior in Children and Adolescents: A Review of Quality, Features, and Behavior Change Techniques

Highlight by Giuseppe Musumeci

Sedentary behavior has become a very popular topic for research and translation since early studies on TV viewing in children in the 1980s. The most studied area for sedentary behavior health outcomes has been adiposity in young people. However, the literature is replete with inconsistencies [7]. Low levels of physical activity and large amounts of inactivity or sedentary behavior are widely assumed to be causally involved in the etiology of obesity and underlie public health messages globally. Unhealthy diet, physical inactivity, and sedentary behavior are highly prevalent health risk factors in children and adolescents. These health behaviors are known to track from childhood into adulthood [8,9] and contribute to high rates of childhood overweight/obesity and an increased prevalence of type 2 diabetes and metabolic syndrome in adolescence. Smartphones and tablets, including the software applications (apps) that run on these devices, have become an integral part of children and adolescents' lives with large increases in usage rates since their introduction in 2007. The number of commercial apps to improve health behaviors in children is growing rapidly. While this provides opportunities for promoting health, the content and quality of apps targeting children and adolescents is largely unexplored. The paper by Stephanie Schoeppe and coauthors [10] evaluated the content and quality of apps to improve diet, physical activity, and sedentary behavior in children and adolescents and examined relationships of app quality ratings with number of app features and behavior change techniques (BCTs) used. Systematic literature searches were conducted in iTunes and Google Play stores between May–November 2016. Apps were included if they targeted children or adolescents and focused on improving diet, physical activity, and/or sedentary behavior. In total, 25 apps were included targeting diet (n = 12), physical activity (n = 18), and sedentary behavior (n = 7). The authors concluded that popular commercial apps to improve diet, physical activity, and sedentary behavior in children and adolescents had moderate quality overall and scored higher in terms of functionality. Most apps incorporated some BCTs, and higher quality apps included more app features and BCTs. Future app development should identify factors that promote users' app engagement, be tailored to specific population groups, and be informed by health behavior theories. In conclusion, to help improve readers' understanding, more formative research is needed to determine the utility of new tools and technology (app, video games as Nintendo Wii, activity tracker, and so on) in the dissemination of regular exercise and healthy nutrition to adolescents to avoid sedentary behavior problems [6,11,12]. Moreover, the impact of such tools in maintaining good health and in reducing risk factors for some chronic disorders must be better elucidated and studied. This topic, given its importance in improving the physical conditions of sedentary adolescents, deserves the full attention of the scientific community.

2.2. Molecular and Systemic Effects Linking Exercise to Cancer Prevention and Cancer Control

Highlight by Elena Barbieri, Mauro De Santi, and Elisabetta Falcieri

It has been 20 years since *skeletal muscle* was recognized as an *endocrine organ*, and skeletal muscle contraction and myokine release have received attention as exercise-induced health benefits. Physical activity (PA) has been shown to reduce cancer incidence, inhibit tumor growth, and improve clinical outcomes following a diagnosis of a primary disease [13], yet daily energy expenditure from PA is decreasing at an alarming rate in Western society [14] In particular, inactivity is associated with an increased risk of breast cancer (BC).

Pernille Hojman and collaborators from Bente K. Pedersen's research team describe the latest molecular understanding of the systemic effect of exercise on cancer progression control. They defined a direct effect on tumor-environment factors linked to whole-body exercise remodeling, mitigation of

cancer-related adverse events, and amelioration of anti-cancer treatment efficacy. Several preclinical studies on the effect of exercise on cancer outcomes point to a reduction in the rate of tumor growth [15,16]. However, an important finding of these studies is that exercise, per se, is not capable of directly eliminating already established tumors. For example, in response to exercise-conditioned serum treatment, BC cell growth is inhibited by 10–15% compared to tumor growth observed in the control setting, but there is not a complete eradication of cancer cells [17,18].

Recent investigations have stressed the role of circulating growth factors, prohormones, and sexual hormones, which are able to stimulate cancer cell proliferation through the activation of their respective receptors [19,20]. In particular, the phosphoinositide 3-kinase-AKT-mammalian target of rapamycin (PI3K-AKT-mTOR) pathway is a frequently hyperactivated pathway in cancer and is important for tumor cell growth and survival. Many studies have shown a down-regulation of PI3K-AKT-mTOR signaling after exercise; however, to date, none have established the exercise-dependent mechanisms underlying this association. Exercise inhibits *mTOR* functions in both AMPK-independent and -dependent manners. AMPK is also induced in tumors during exercise [21,22], probably as a transient condition. It is known that intra-tumoral metabolism is regulated, but how this affects tumor growth and metastatic rate during exercise is not currently understood. Chronic exercise induces physiological adaptation across homeostatic control circuits, such as oxidative metabolism, mitochondrial biogenesis in several tissues, angiogenesis, immune regulation, and metabolism. Moreover, it diminishes BMI and blood concentrations of estrogens, and insulin, decreases insulin resistance, and strengthens anti-inflammatory pathways against tumor cells. Hence, exercise has an increasingly protective tumorigenic effect [23–28]. These findings have wide-ranging implications for society and may lead to improve the way cancer is managed.

2.3. Physical Activity Counseling in Breast Cancer Survivors

Highlight by Valentina Natalucci and Luciana Vallorani

The overall prevalence of women living with a diagnosis of breast cancer (BC) is increasing in industrialized countries. Survivors who maintain a healthy weight and stay physically active (PA) have a better response to treatment and better survival outcomes. Thus, it is necessary to identify an appropriate promotion and prescription of regular PA for BC survivors to improve their prognosis, response to therapy, and quality of life. In this issue, Fong AJ and colleagues [29] examine factors affecting exercise counseling by clinicians and discuss future strategies to address oncology clinicians' perceptions of PA counseling and barriers to such counseling in BC survivors. Focus group discussions were transcribed verbatim and analyzed using inductive thematic analysis. In order to facilitate PA counseling, healthcare facilities, and clinicians need to better support and promote patient-managed PA, making it available on multiple platforms and providing better referral pathways to exercise professionals and physiologists.

2.4. Protocol for Exercise Prescription among Breast Cancer Survivors

Highlight by Deborah Agostini and Giosuè Annibalini

Recent systematic reviews and meta-analyses tend to aggregate exercise programs into general categories and rarely investigate the specific features of these programs, which may make them more or less effective. What physical activity (PA) should be prescribed for breast cancer (BC) survivors?

Not all types of exercise carry the same benefits. Specificity is a core principle of exercise training to promote the desired adaptations, and the specificity of adaptation is underpinned by the acronym FITT, which stands for frequency, intensity, time and type. The FITT principle outlines the key components of an effective exercise program Overall recommendations for cancer survivors are consistent with the American Cancer Society, who recommends that cancer survivors engage in a minimum of 150 weekly minutes of moderate-intensity exercise, and it is important to note that the American College of Sports

Medicine [30] has established FITT guidelines that are easy to follow for exercise prescription that everyone should know. Frequency refers to how often exercise is performed, intensity refers to the intensity of the exercise undertaken, time refers to the amount of time spent exercising, and type refers to the kind of exercise that is performed. However, adherence to any exercise program is the most difficult thing to achieve, and currently there is a growing number of initiatives designed to increase the effectiveness of long-term PA in BC patients in the most comfortable environment: at home.

The aim of the study carried out by Mascherini G. and collaborators was to verify the long-term effectiveness of a home-based program for active lifestyle change in overweight BC survivors. They enrolled premenopausal women, whose PA levels, baseline aerobic capacity, flexibility, strength, and anthropometric measurements were assessed. These parameters were assessed six times during one year of unsupervised exercise. After being prescribed an individual exercise program, a significant reduction in BMI and skinfold sum was observed, as well as maintenance of muscle cell mass. Assessments also showed an increase in lower limb muscle fitness and a reduction in diastolic blood pressure after a six-minute walking test. Exercise is highly recommended for cancer patients, and the prescription of a home-based model of unsupervised exercise described by Mascherini G. et al. seems to ensure ideal compliance, favoring long-term therapeutic efficacy [31].

This intervention strategy could target all patients affected by BC and might motivate these subjects to adopt a healthier lifestyle based on regular PA, as well as proper nutrition.

2.5. Physical Activity and Sedentary Behavior: The Debate

Highlight By Laura Stefani

Recently, types and amount of physical activity have been widely investigated in sports medicine, appealing to the "Exercise is medicine" field of interest. The physical activity evaluation cannot be separated by specific information regarding "sedentary behavior". A debate is often found in the literature regarding the definition of the regimen of the time, intensity, and rate of physical exercise [32]. Self-reported measures, such as questionnaires, have a limited ability to detect physical activity especially for unstructured activities. A definition of sedentarism has been, in any case, expressed. Sedentary behavior was defined as <100 counts/minute as reported by Owen and Matthews [33,34]. Sedentary bouts were defined as $\geq$30 min with at least 80% of the minutes falling below sedentary activity. Accelerometry, in various models, represents the correct method to distinguish and to evidence the intensity of exercise, especially to distinguish moderate versus vigorous levels [34]. As reported by Kelly R Evenson, the accelerometry pattern is an important determinant to identify the most active population. The defined cut-points for a moderate level of PA represent the estimation of moderate vigorous physical activity (MVPA) out of total wearing time. On the basis of sedentary behavior, this approach has contributed to identify five classes of subjects: the most active 65.3% of the population (weighted mean 9.3 min/day); the next 24.9% of the population (32.1 min/day); 3.2% that was low on the weekdays but much higher on the weekends (52.0 min/day); 5.9% (59.9 min/day); and 0.7% in the highest class (113.6 min/day).

Using the lower MVPA threshold, by contrast, a latent class of sedentary behavior emerged with a marked rise in the percentage of time spent in sedentary behavior on the weekend (weighted mean 336.7–346.5 min/day) compared to weekdays (weighted mean 255.2–292.4 min/day). This model can evidence the latent class analysis (LCA) of six diverse classes at different levels of physical activity: 6.3% of population (weighted mean 660.2 min/day), 25.1% (546.8 min/day), 37.7% (453.9 min/day), 24.0% (354.8 min/day), and 7.0% (256.3 min/day). Four of the classes showed generally similar results across every day of the week, with the absolute percentages differing across classes. In contrast, the least sedentary class showing a marked rise in the percent of time spent in sedentary behavior on the weekend (weighted mean 336.7–346.5 min/day) compared to weekdays (weighted mean 255.2–292.4 min/day).

This is particularly useful for those subjects who are much more active on the weekends (52.0 min/day). In the same paper the author clarified that "As a complement to self report [sic], accelerometers can provide detailed measures of time spent in both physical activity and sedentary behavior".

The LCA model has supported the identification of five or more distinct patterns for indicators of the total volume of physical activity. This pattern, as the literature reports [35], can be used as intervention targets and as independent or dependent variables in future studies to correlate to some determinants or outcomes.

2.6. Physical Activity and Sedentary Behavior: Discriminative Comparative Study in Knee Osteoarthritis (OA) Patients

Highlight by Marta A. Szychlinska

In this sixth Journal Club, regarding physical activity and sedentary behavior, I would like to highlight the interesting paper by Sliepen et al. [36], published recently in BMC Musculoskeletal Disorders. The paper focuses its attention particularly on the objectivity of the effects of physical activity frequency, intensity, time, and type (F.I.T.T.) dimensions and sedentary behavior in knee osteoarthritis patients, which experience subjective activity limitations during daily life. The authors suggest a more discriminative approach compared with general outcome measures that describe overall levels of physical activity or sedentary behavior. A cross-sectional, exploratory study was conducted to assess physical activity, sedentary behavior, and physical function in German patients. The study enrolled several subgroups of knee osteoarthritis patients, based on different risk factors. The 61 patients performed mean level steps, ascending and descending steps, and bicycle crank revolutions daily. Most waking hours were spent sedentary (61%), with bouts of long duration (>30 min). Specific events, particularly ascending and descending stairs/slopes, brief walking, sedentary bouts, and prolonged walking bouts, varied between subgroups. The knee osteoarthritis patients were monitored for one week with a tri-axial accelerometer. Patients were instructed to wear the device for seven consecutive days during waking hours, except for water-based activities. The device was worn on the lateral side of the right thigh, halfway between femoral head and the tibial plateau, attached by double-adhesive tape. Relevant parameters of the F.I.T.T. dimensions were extracted using custom-developed MATLAB algorithms. Participants filled in a daily log reporting on wear times, experienced pain through a numeric rating scale (NRS; 0 is no pain, 10 is worst conceivable pain), and physical activity events that could not be monitored with the algorithms (i.e., resistance exercise, swimming, gardening, and household activities). Patients were asked to fill in the Knee Osteoarthritis Outcome Score, a valid and responsive questionnaire covering several disease-related domains, ranging from 0 (most severely affected) to 100 (not affected). Furthermore, patients were asked about a previous knee injury, their job and employment status, and whether they performed any sports on a regular basis. Patients were grouped based on different parameters. The authors observed that the most common form of activity was level walking, highlighting the relevance of distinguishing between different types of physical activity. However, the total active time was very poor, as the patients spent most of their time sedentary. The authors concluded that, event-based parameters, such as stair climbing or short bouts of walking or sedentary time, were found more capable of discriminating between subgroups of knee osteoarthritis patients compared with overall levels of physical activity and sedentary time. Thereby, subtle limitations in the physical behavior of different subgroups were revealed, which might ultimately be targeted in rehabilitation programs.

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