The template below must be accompanied by a separate document containing a [cover letter and appropriate checklist](https://docs.google.com/document/d/1Mqs5VfgyV8nD-Jof20Y2YR_u5rYxWERe/edit?usp=drive_link&ouid=116380667144688054119&rtpof=true&sd=true).

Please download this document (click “File” > “Download” > “Microsoft Word”). Upload this document in the “Full Text of Submission” location of the submission (use the “Upload file from your computer” option). Delete this and the previous five lines prior to submission.



*Original Research / Systematic Review / Meta-Analysis / Brief Report*

(Select one, delete others)

Title in Title Case (Bold, Justified, 14pt font)

## Abstract

***International Journal of Exercise Science V(I): pg-pg, year.*** The aim of this study was to compare the warm-up effects of a treadmill walking warm-up (TW) with a dynamic warm-up (DW) on the responses to cardiopulmonary exercise testing (CPET) in youth. A sample of 16 active youth (age 13.6 ± 1.8 yr) were tested for peak oxygen uptake (VO2 peak) using the Fitkids treadmill test protocol on 2 nonconsecutive days following different 6-min warm-up procedures. The TW consisted of walking on a treadmill at 2.2 mph and 0% grade whereas the DW consisted of 12 bodyweight exercises with a 2 kg medicine ball. Maximal heart rate (HR) was significantly higher following DW vs TW (200.8 ± 6.16 vs. 197.9 ± 7.3 bpm, respectively; p < 0.05), whereas no significant differences were found between DW and TW for VO2 peak (50.5 ± 9.9 vs 50.6 ± 11.1 ml/kg/min), maximal minute ventilation (VE; 93.0 ±21.4 vs. 92.7 ±21.2 L/min), maximal respiratory exchange ratio (1.19 ± 0.08 vs 1.22 ± 0.08), and total exercise test time (668.1 ± 103.5 vs 686.3 ± 97.0 s), respectively. During the Fitkids treadmill test protocol HR and VE were significantly higher following DW vs TW at stage 1, stage 2, stage 3 and stage 4, and oxygen uptake was significantly higher following DW vs TW during stage 1 (all p < 0.05). Findings indicate a DW elicits a higher maximal HR and higher submaximal HR, VE, and oxygen uptake values than TW during CPET in youth, although no differences in VO2 peak were observed.

Example is provided above. Begin with background for study justification. Provide a purpose statement. Include relevant methods for data collection and data analysis. Present findings with supporting data (means, *p* values, etc.). Provide discussion items of importance and potential limitations. Also consider giving directions for future research, if space allows. The abstract should be 250 words or less.

Keywords: Aerobic capacity, children, dynamic warm-up, heart rate, priming

List three to five key words or phrases that describe the study, but are not included in the title. They should be separated by commas.

## 

## Introduction

Cardiopulmonary exercise testing (CPET) is commonly used in clinical and research settings to assess the health status and aerobic fitness of children and adolescents.24,26 Physiological responses to submaximal and maximal aerobic exercise can provide important information about cardiopulmonary function, abnormal exercise responses, and disease severity.23,27 In addition, CPET can assist in establishing a baseline biometric, designing an exercise program, tracking progress, and encouraging ongoing participation in physical activities.4 While field tests such as the 20-m shuttle run and 6-min walk test are reliable and sensitive to exercise interventions,19-20 they lack the physiological information required to objectively measure the responses of the cardiopulmonary system to incremental exercise. CPET is considered the gold standard because it combines standard graded exercise testing with simultaneous ventilatory respired gas analysis.8

This section explains the context or background for the study. While a full review of literature is not appropriate here, enough detail must be provided for readers to understand the reason for conducting the experimentation. The goal of an Introduction is to present the research topic and capture the reader’s interest. You should summarize existing research and identify gaps. From these gaps, define your specific research problem and novelty. Include a statement of purpose or statement of hypothesis. [*Resource for further reading.*](https://paperpal.com/blog/researcher-resources/how-to-write-a-research-paper-introduction-with-examples)

In text citations should follow AMA style. …

## Methods

### Participants

To determine the minimum number of participants, a priori power analysis was run by the software GPower (version 3.1.9) with a desired power level of 0.80, an alpha level of 0.05 and effect size calculated from previous studies.2-3 A sample of 17 youth initially volunteered to participate in the study; however, one participant was unable to complete all procedures due to a sport-related injury not related to the study. The final sample included 16 youth (5 females, 11 males and 0 specified otherwise; mean ± SD age 13.6 ± 1.8 yr; height 162.8 ± 9.9 cm; body mass 57.8 ± 13.2 kg). Parents completed a modified physical activity readiness questionnaire to assess the health status of the participants. All participants were healthy and regularly participated in sport activities. Exclusion criteria included cardiovascular issues, metabolic conditions, neuromuscular disorders, orthopedic limitations, or acute illness. Prior to the start of the study, all parents and participants were informed about study aims and procedures, and parents signed a parental permission form and youth signed a child assent form. This study was approved by the Institutional Review Board at The College of New Jersey. This research was carried out fully in accordance with the ethical standards of the *International Journal of Exercise Science*.22

In the participants section, the authors must provide inclusion and exclusion criteria for the sampled population. There must be an explicit statement that all participants signed an informed consent (or assent if minors or someone who is unable to give informed consent were tested) and that all study procedures were approved by a human subjects board (e.g., IRB) in accordance with the ethical standards set by the Helsinki Declaration. The editors of *IJES* take ethical standards very seriously and ask that authors acknowledge that their work is in alignment with our particular standards published, “Ethical Issues Relating to Scientific Discovery in Exercise Science.” To do so, the authors must include a statement and accompanying citation. An example is provided; "This research was carried out fully in accordance with the ethical standards of the International Journal of Exercise Science7" along with the following reference in text and in the reference list: Navalta JW, Stone WJ, Lyons TS. Ethical issues relating to scientific discovery in exercise science. *Int J Exerc Sci*. 2019;12(1):1-8.

Authors are also expected to disclose how the sample size was determined through either an (1) a priori power analysis or (2) a scientific rationale for the number of participants tested that is accompanied by a rationale for why a power analysis could not be conducted. If you have any questions regarding this requirement, please reference the editorial published in volume 13(1) 1-5. Power analysis should be accompanied by a citation that justifies the numbers included in the evaluation. The example in the text is considered satisfactory.

Specific to the variable of sex or gender, consider reporting how this data was collected in a respectful and inclusive manner, ideally allowing participants to self-identify and ensure that specific questions about gender identity and sexual orientation are relevant to the study's objectives.

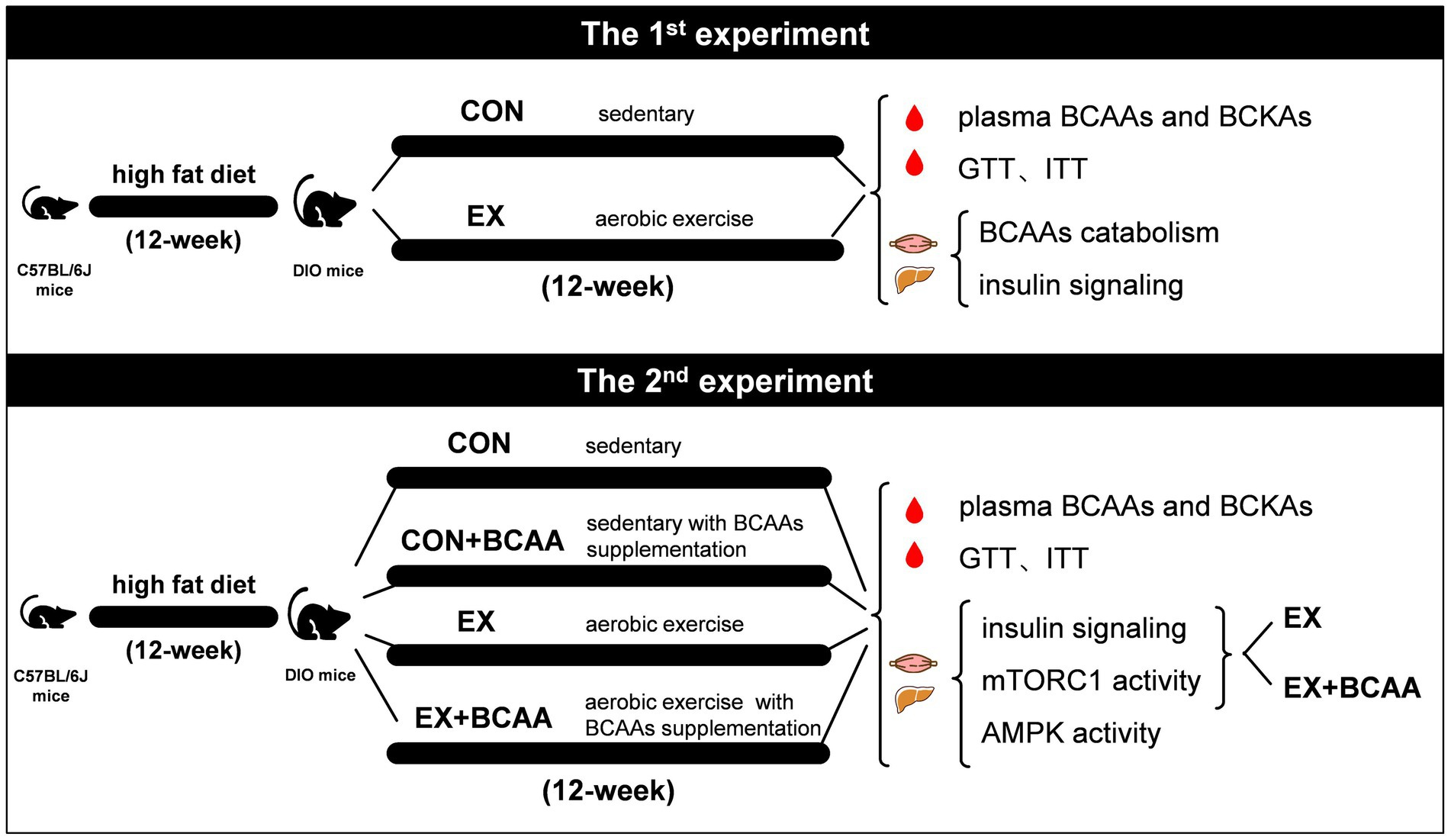
### Protocol

Participants reported to the Human Performance Laboratory on two nonconsecutive days (within 1 week) at the same time of day under controlled temperature conditions. Height was measured using a wall-mounted stadiometer and body mass was measured using an electronic scale. Peak aerobic capacity testing was conducted by the same researchers. Participants were given standardized instructions before the start of the test and verbal encouragement during the test. The Fitkids treadmill test protocol and a calibrated metabolic system (MedGraphics ULTIMA Metabolic System, MedGraphics Corporation, St Paul, MN, USA) were used to assess peak oxygen uptake (VO2 peak). The Fitkids treadmill test is a valid and reproducible exercise protocol designed for children and adolescents that consists of 90 s stages with gradual increments in speed and incline.18

It is in this section that the authors describe, in great detail, the methodology for the study. This includes how data were collected including equipment or apparatus used (provide manufacturer name and geographical location in parentheses), and procedures to allow for other investigators to replicate the results if desired. If the authors replicate study design from a formerly published study, they may consider referencing that study and minimizing the description to avoid plagiarism.

​​**Table 1.** Dynamic warm-up exercises with a 2 kg medicine ball (MB).

| Number | Exercise |
| --- | --- |
| 1 | Standing high knee march holding MB near chest |
| 2 | Standing high knee march pressing MB overhead 5x |
| 3 | Jog in place holding MB near chest |
| 4 | Jog in place holding MB near chest with heel kicks |
| 5 | Jog in place with MB chest presses 5x |
| 6 | Jog in place while tossing and catching MB 5x |
| 7 | Jog in place holding MB near chest with squats 5x |
| 8 | Jog in place holding MB near chest with squats and MB chest presses 5x |
| 9 | Split squats holding MB near chest 5x each side |
| 10 | Alternating lunges holding MB near chest 5x each side |
| 11 | Jumping square dot drill holding MB near chest |
| 12 | MB slams to floor 5x |



**Figure 1.** Experimental testing overview. *Sourced from* [*Cao et al. (2024)*](https://www.frontiersin.org/journals/nutrition/articles/10.3389/fnut.2024.1451429/full)

If the authors wish to include a table or figure, it must be referenced in the text. **Tables**: Tables should be created in your word processor and remain editable to the Editors if future formatting is needed. When designing your table(s), there should be no horizontal lines outside of the ones encapsulating the first row and a final line to end the table. A title should be included above the table or below a figure. **Figures** and tables should be clear and preferably built in Word format. If the figure(s) is not built within your word processing program, please comply with the following expectations: (1) figure resolution and clarity should be a minimum of 300 pixels per inch (PPI); (2) sharp lines and legible labels are included; (3) simple and contrasting color scheme is used with minimal use of patterns; (4) format of figure should be a TIFF or PNG to preserve quality through distribution. Consider incorporating alternative (alt) text into figures. Alt text is a short piece of text that describes and is embedded within a table, figure, or image. Assistive technology, reads the alt text, making content accessible to people who have a visual disability and cannot read or see it.

### Statistical Analysis

Descriptive statistics (mean ± SD) were calculated for all dependent variables. A paired *t*-test was used to compare maximal HR, VO2, VE, RER, and exercise test time between the TW and DW protocols, and to compare submaximal HR, VO2, and VE values during the first four stages of the Fitkids treadmill test protocol. All participants completed at least 5 stages of the FTT. A paired *t*-test was used to compare order effects between test day 1 and test day 2 for all variables, and to compare warm-up HR between TW and DW. For all statistical tests, a probability level of *p* ≤ 0.05 denoted statistical significance. Effect sizes were calculated using Cohen’s *d* and were interpreted as ~0.2 = small effect, ~0.5 = moderate effect, and ≥ 0.8 = large effect (7). Statistical analyses were conducted in SPSS (version 24; SPSS, Chicago, IL, USA).

Statistical methods should be described in enough detail to allow a knowledgeable reader, with access to the original data, to verify the reported results. Details to include are computer software used and the a priori alpha-level used for determination of significance; testing assumptions for parametric testing; planned analyses based on study design (e.g., repeated measures ANOVA, Chi-square, Kolmogorov-smirnov test); interpretation of effect size or secondary measure accompanying reported results.

## Results

Maximal heart rate was significantly higher following DW than TW (*p* < 0.05, ES = 0.32, Table 2). We found no differences in VO2 peak, maximal VE, maximal RER, and exercise test time between warm-up procedures (Table 2). During the Fitkids treadmill test protocol, HR and VE were significantly higher following DW than TW at stage 1, stage 2, stage 3 and stage 4 (all *p* < 0.05), and oxygen uptake was significantly higher following DW than TW at stage 1 (*p* < 0.05, ES = 0.18) (Table 3). No significant order effects were observed between test day 1 and test day 2 for any variable (data not shown). The mean HR during the DW protocol was significantly higher than during the TW protocol (142.0 ± 24.0 vs 104.1 ± 17.2 bpm, respectively, *p* < 0.05, ES = 0.41). No adverse events occurred during testing sessions.

**Table 2.** Descriptive Statistics

| Variable | Content |
| --- | --- |
| 1 | Data for variable 1 |
| 2 | Data for variable 2 |
| 3 | Data for variable 3 |

*Note*:

The results should be reported in a logical sequence, giving the main findings first. The use of descriptive text, tables, and figures should be unique and not repeat information. Tables and figures should be restricted to those needed to explain the argument of the paper. If there is not a research question answered by a table or figure (outside of providing sample descriptives), it should not be included. Consider substituting a figure for a table with many entries to improve consumability of the data.

Statistical output should be provided, including a minimum of the findings from the statistical test including the test statistic, *p* value, and measure of effect. A few examples are below (see more examples [here](https://www.scribbr.com/apa-style/numbers-and-statistics/)):

* ANOVAs: degrees of freedom (between, within groups) in parentheses, *F* value, *p* value, measure of effect.
  + The evaluation revealed no main effects for sex (F1,43 = 0.21, p = 0.646) or class (F1,43 = 0.13, p = 0.721) on ΔECTO from pre- to post-season. However, a significant interaction was observed where female, underclass-members demonstrated an increase in ΔENDO while female, upper class-members saw a decrease in ΔENDO (F1,43=6.58, p = .014, np2 = 0.133).
* Regressions: *R2* value (coefficient of determination), *F* value (or *F* statistic), degrees of freedom (in parentheses), and the *p* value.
  + BMI scores predicted risk for cardiovascular disease, *R2* = .55, *F*(1,50) = 6.82, *p* = 0.03.
* *t* tests: *t* value (or *t* statistic), degrees of freedom (in parentheses), *p* value, measure of effect..
  + Those with general anxiety disorder are more likely to benefit from group exercise sessions than the control, *t*(40) = 4.45, *p* < .001, ES = 0.28.

## Discussion

We hypothesized that a DW would elicit higher submaximal and maximal responses than TW during pediatric CPET. We found that a DW elicited higher maximal HR than TW but no significant differences between warm-up protocols were observed for VO2 peak, maximal VE, maximal RER and total exercise time. In agreement with our hypothesis, higher submaximal HR, VE and oxygen uptake values were observed following DW than TW. Our central findings build on previous reports (10, 17) and demonstrate that warm-up procedures can affect some physiological measures during CPET in youth. These findings may be of relevance to clinicians and researchers because submaximal and maximal responses to exercise testing are often used to evaluate peak aerobic capacity, assess the effectiveness of exercise interventions, and provide insights about physiological limitations.

Our HR results support the limited data available on warm-up effects prior to CPET in youth (10, 17). In our study maximal HR following the DW and TW protocols were ~201 bpm and ~198 bpm, respectively. These observations are similar with a previous study that found significantly higher maximal HR following dynamic warm-up activities as compared to warm-up treadmill walking (~194 bpm vs ~192 bpm, respectively) in children (10). Our findings are also consistent with an earlier study that reported a maximal HR of 196 bpm following warm-up intermittent running as compared to a maximal HR of 188 bpm following no warm-up in young boys (17). In our study, submaximal HR during the first 4 stages of the Fitkids treadmill test protocol were significantly higher following DW as compared to TW, and these observations are in line with previous findings (10). Submaximal HR was ~11 to 14 bpm higher during the first four stages of the Fitkids treadmill test protocol following DW as compared to TW. These findings can have significant implications because an overestimation of submaximal HR during a submaximal exercise test can underestimate predicted peak aerobic exercise capacity (25).

The Discussion should start by restating the purpose of the investigation and how the analyses answer the research question(s). This section emphasizes new and important aspects generated from the study. Do not simply repeat information previously given in the Introduction and/or the Results section. The Discussion should compare and/or contrast the results with previous research and provide the implications of the findings of future research. Be careful to not make unqualified statements that are not adequately supported by the study data.

## Acknowledgements

Include statements related to funding and support sources, disclaimers, or contributions that do not warrant authorship.

Consider providing a land acknowledgement as a way of showing respect for the Indigenous Communities with whom the work was performed, or whose historic land was taken, now being used by academic institutions and its employees. The National Environmental Education Foundation provides guidance on creating a land acknowledgement. The process involves first identifying the traditional inhabitants of the land at https://native-land.ca . Next, while there is no precise language recommendation, an articulation of acknowledgement is appropriate (see the example below). Finally, once the statement has been created, include the acknowledgement in the manuscript.

Example land acknowledgement: “We respectfully acknowledge that the International Journal of Exercise Science, and Western Kentucky University, are headquartered and located on the ancestral land of the ᏣᎳᎫᏪᏘᏱ Tsalaguwetiyi (Cherokee, East) people.”

## References

Format references as noted under our style guide (AMA format). In general, please follow the following format for scientific articles:

AuthorLastname FirstInitialMiddleInitial. Title in sentence case. *Abbreviated Journal Title in Title Case*. Year;volume(Issue#):PP-PP. https:doi: ##

*Example*:

Reeves R, Hicks O, Navalta JW. The relationship between upper arm anthropometrical measures and vertical jump displacement. *Int J Exerc Sci*. 2008;1(1):22-29. <https://doi.org/10.70252/FJTF9033>

References should be numbered in the reference list, based on the order presented in the text. Citations in the text should be numbered according to their reference list location.

Check DOI by using this link: <https://apps.crossref.org/SimpleTextQuery>

Ensure it is a connected link

Original research manuscripts are limited to 40 references (the exception would be for systematic reviews with or without meta-analyses).

Add a 10 pt space between each reference.