THE EFFECTIVENESS OF BIKE FITTING IN IMPROVING TIME ON A 1-KM CYCLING TIME TRIAL OF AN AMATEUR ROAD CYCLIST

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ABSTRACT

Low back pain, particularly in the lumbar region, is a pervasive global health issue, posing a significant burden on individuals, healthcare systems, and economies. According to Wu et al. (2020), it is the leading cause of disability globally, affecting people of all ages, ethnic backgrounds, and socioeconomic statuses. As stated by the World Health Organization (WHO) categorizes it as a major contributor to years lived with disability (YLD), emphasizing its substantial socioeconomic implications. Notably, Low Back Pain (LBP) is not confined to a specific age group, with children, adolescents, and individuals of all ages susceptible to its impact. The researchers aim to shed light on the acceptability of the Vibration Device among Physical Therapists in the realm of low back pain management. The study aims to contribute valuable insights into the practicality and user satisfaction of incorporating a vibration device into therapeutic practices. The emphasis on acceptability aligns with a wider goal of understanding non-invasive interventions, prioritizing their role in enhancing pain relief and elevating overall quality of life, thereby making a substantial impact in clinical settings. The Methodology of the study used a quantitative research design, specifically a survey designby Bhandari (2020). The process of gathering and interpreting numerical data is referred to as quantitative research. It can be used to identify patterns and averages, formulate hypotheses, examine relationships, and generalize findings to larger populations. With this design, the researchers conducted their studies and gathered data using surveys that provide open-ended questions that can be answered using the Likert scale. The result of the overall acceptability of the device has a mean of 3.86 which has a verbal interpretation of moderately acceptable according by Salac, D. (2020). This is based on the sub-problems of appearance, quality, safety, ease of use, and usefulness. The results of the study have concluded that the device is accepted by the physical therapists for implementation in the realm of low back pain management.

Keywords: Bike fitting, Amateur cyclists, Cycling time trial, Road cycling

INTRODUCTION

Time trials, the heartbeat of precision and endurance in the cycling world, are a testament to an athlete's solitary battle against the clock. A unique discipline where riders challenge not

only their competitors but also their limits, time trials unveil the pure essence of speed, strategy, and mental fortitude. In the world of cycling, achieving optimal performance and preventing injuries is a delicate balance. One crucial factor that often goes underestimated is the art and science of bike fit. Bike fitting involves adjusting the biomechanics of the bike to suit the individual cyclist's body and capabilities, aiming to improve performance and reduce the risk of injuries. According to Lindsey, bike fitting is a process aimed at tailoring a bicycle's configuration to the specific needs of the rider. It involves making precise adjustments to the bike's components, including saddle height, handlebar position, pedal alignment, and more, to ensure that the rider's body is in an optimal position for comfort, performance, and injury prevention.

An incorrect body position while cycling can lead to several overuse injuries. Even minor alterations, especially at the points where the body interacts with the bike, can impact the rider's biomechanics along the entire body, ultimately enhancing comfort, efficiency, and the ability to generate power. Every person has a unique measurement in terms of bike fitting, which is why it is important that a bike fitter has knowledge of anatomy and kinesiology when doing a bike fit, and this is to ensure comfort for every cyclist. Physical therapists are highly trained individuals who specialize in optimizing movement and function. Anatomy and kinesiology are also some of the fields that physical therapy mastered. The knowledge of a Physical Therapist about bike fit extends far beyond the basic adjustments of seat height and handlebar positioning. They possess a deep understanding of how the human body interacts with the bicycle, considering an individual's unique physiology, flexibility, and riding goals.

Despite its importance, there remains a significant research gap regarding the relationship between bike fit and the prevention or management of cycling-related injuries, particularly hip and lower back pain. Limited empirical studies have examined how improper fitting contributes to these issues, and even fewer have explored the role of physical therapists in addressing them through biomechanical interventions. Furthermore, there is a lack of comprehensive understanding of how body positioning during time trials may predispose athletes to overuse injuries, underscoring the need for more focused research in this area. Bridging this gap could not only enhance athletic performance but also lead to more effective injury prevention strategies tailored to individual cyclists.

LITERATURE REVIEW

Physical therapists play an essential role in the healthcare system by helping patients and communities improve their movement and overall function. Their expertise in anatomy and kinesiology enables them to assess, diagnose, and create personalized treatment plans that address specific physical needs (Whittaker et al., 2019; Carroll, 2021). This advanced understanding is particularly valuable in specialized interventions such as bike fitting, where precise adjustments can significantly impact a cyclist’s performance and comfort (Wadsworth & Weinrauch, 2019).

In recent years, cycling has grown in popularity, especially during the COVID-19 pandemic, as people sought healthier, more sustainable modes of transportation and recreation (Ito & Cheer, 2022; Gaspay et al., 2022; Ciascai et al., 2022). However, the rise in cycling has also been accompanied by an increase in musculoskeletal injuries, often resulting from improper bike setup, overtraining, and poor riding posture (Schwellnus&Derman, 2014; Fenelon et al., 2018). The type of bicycle used—whether a road bike, mountain bike, or hybrid—plays a

role in the cyclist's experience, but regardless of type, a properly fitted bike is crucial for optimal performance and injury prevention (Arriel et al., 2022; Gupta & Kalra, 2023; Hamoodi et al., 2022).

Bike fitting involves adjusting key components such as the saddle height, handlebar position, and pedal alignment to suit the rider's unique body mechanics. These adjustments not only enhance comfort but also improve biomechanical efficiency, increase power output, and minimize the risk of overuse injuries (Kotler et al., 2016; Burt, 2022). Research has shown that a properly fitted bike can lead to better pedaling mechanics, greater kinematic stability, and improved time trial performance (Choi et al., 2018; Holliday & Swart, 2021; Wiles et al., 2023).

Moreover, maintaining an ergonomic cycling posture, supported by a proper fit, is vital for preventing common discomforts and injuries associated with the sport, such as lower back pain, knee strain, and wrist issues (Salvendy & Karwowski, 2021; Huang et al., 2018; Said et al., 2022). Given these factors, our study aims to explore the effectiveness of bike fitting in enhancing the performance of amateur road cyclists, specifically by measuring improvements in their 1-kilometer cycling time trial results. By understanding the impact of professional bike fitting, we hope to contribute valuable insights to both the fields of physical therapy and sports performance.

METHODOLOGY

The study utilized a quasi-experimental type of research to investigate the effects of bike fitting. This study used protocols and measurement instruments to assess the outcome of the exercise intervention and determine variations of results. In accordance with these procedures, the researchers used the Single-Group Pretest-Posttest Research Design as this incorporates both pre-test and post-test studies by conducting a single-group evaluation before and after time trial. The outcome measure, the 1-KM cycling time trial, will be carried out to the selected amateur road cyclists before and after the bike fit to determine its effectiveness in improving their performance. The data obtained using this research design will allow the researchers to numerically compare the pre and post effects of the bike fitting on the selected outcome, which were essential in answering the hypothesis of the study.

For the respondents for the study, the researchers based on the following inclusion criteria: (1) Amateur Cyclist; (2) Sex; (3) At least 18 years old; (4) No recent injuries for the past 3 months, (5) 2 years or more experiences of cycling, (6) has a road bike, (7) uses bike cleats, (8) Did not have any bike fitting services, and (9) currently residing in Barangay Sala, Cabuyao, Laguna. On the other hand, the respondents were excluded if they are (1) with asthma; (2) prior history of surgery of the back and hamstrings with any pain for more than 3 months; (3) anti-inflammatory medication in the past 2 weeks; (4) hypertension; (5) history of trauma; (6) impaired balance conditions; (7) Use of performance-enhancing drugs or substances. For the research instruments, the researchers utilized the 1-KM cycling time trial test as an outcome measure to assess the performance of the amateur cyclists before and after the implementation of the bike fitting. The outcome measure will be used to collect the primary data needed.

RESULTS

Table 1 shows the pre-test scores of the participants with the mean score of 106.18 secs.

Table 1
Respondent's Pre-test Scores in the 1-KM cycling time trial

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	30	88.08 secs	130.99 secs	106.18 secs	10.18232
Valid N (listwise)	30				

The maximum pretest score was 130.99 secs and the minimum was 88.08 secs. The standard deviation of 10.18(SD = ± 10.18) which indicated that the pre-test time of the respondents were dispersed. The pretest scores served as a baseline to measure the effectiveness of bike fitting in improving 1-km cycling time trials on amateur road cyclists by comparing pre and post-fitting times

Table 2 shows the pre-test scores of the participants with the mean score of 104.86 secs.

Table 2
Respondents' Post test Scores in the 1-KM cycling time trial

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	30	86.80 secs	128.8 secs	104.86 secs	10.01476
Valid N (listwise)	30				

The maximum pretest score was 86.80 secs and the minimum was 128.8 secs. The standard deviation of 10.01 (SD = ± 104.86) which indicated that the pre-test time of the respondents were dispersed. Based on the study conducted by (Wiles et al., 2023) The results in their study indicates a significant improvement in performance time in their Post test trial by (2.3 s) in the 1-KM cycling time trial. In conclusion there is a significant time improvement compared to their pretest scores and Bike fitting does improve the overall performance of the cyclist.

Table 3 showscorrelation coefficient between the Pre-test and Post-test were 13.049. The p-value is 0.000, which shows less than the significance level of 0.01. Therefore, there is a significant difference on the pretest and posttest scores in the 1-KM cycling time trial.

Table 3
Significant Difference between the Pre-test and the Post-test scores in the 1-KM Cycling Time Trial

Pre-Test and Post Test	**r**	13.049
	p	.000
	Interpretation	Significant difference exists

**significant level at 0.01

In a similar study conducted by Holliday & Swart, (2021), Choi et al., (2018) indicated that the dynamic Bike fitting had a positive effect such as increased pedaling kinematic stability, increase power output and kinetic efficiency on pedaling performance for improving time in a time trial. In another study by Hetzler (2008), suggest that certain bike fitting adjustments can directly impact power output, which is critical for improving time in a cycling time trial; This means that the after-bike fitting being applied, it significantly decreases the time of 1-KM cycling time trial.

DISCUSSION

The effectiveness of bike fitting in improving the time on a 1-km cycling time trial for an amateur road cyclist was investigated by determining to what extent the objectives of the study have been achieved. Based on the data obtained, presented, and analyzed on Results of the effectiveness of bike fitting in improving the time on a 1-km cycling time trial for an amateur road cyclist, the researchers summarized the study as follows

This research explored how bike fitting influences performance in a 1-KM cycling time trial for an amateur road cyclist. The results indicate that a professional bike fit significantly improved the cyclist's time trial performance, with post-test results showing faster times than pre-test scores. Beyond speed improvements, the adjustments contributed to enhanced flexibility, posture, and range of motion in different areas of the body while also promoting better balance and a more efficient riding form. Statistical findings reinforce these observations, as the correlation coefficient of 13.049 and a p-value of 0.000—well below the 0.01 threshold—confirm that the improvements were both substantial and statistically significant. This highlights the crucial role of proper bike fitting in maximizing efficiency and performance, especially for amateur cyclists aiming to optimize their riding experience.

Prior research aligns with these findings, demonstrating that bike fitting enhances biomechanical efficiency, minimizes unnecessary energy expenditure, and lowers injury risk. Studies on cyclists of varying skill levels suggest that correct positioning and alignment contribute to improved power output and endurance while reducing stress on the joints and muscles. In a study by Holliday & Swart (2021), Choi et al. (2018) observed that dynamic bike fitting positively influenced pedaling mechanics by increasing kinematic stability, power output, and overall pedaling efficiency—factors that play a key role in reducing time during a cycling trial. Additionally, Hetzler (2008) proposed that specific bike adjustments directly impact power generation, making them critical in improving performance. These findings resonate with the present study, reinforcing the idea that professional bike fitting significantly enhances time trial results.

From a practical standpoint, the findings emphasize that both amateur and professional cyclists can benefit from a proper bike fit, as it not only enhances performance but also mitigates injury risks. According to DMU (2015), Poor positioning is a known contributor to musculoskeletal discomfort, including pain in the back, knees, neck, wrists, and hands. Addressing these concerns through optimized fitting can improve efficiency and reduce strain. Theoretically, as stated by Velo System (n.d.) this study contributes to the growing body of research on cycling biomechanics, which focuses on improving the interaction between the cyclist and their bicycle for enhanced posture, alignment, and pedaling mechanics. Clinically, proper fitting has been linked to injury prevention and muscle efficiency, according to the University of Michigan Health (n.d.) supporting the idea that biomechanical analysis programs can enhance both comfort and overall riding performance.

Despite these promising results, certain limitations exist. The study was conducted with a relatively small sample size and within a short time frame, which may affect the broader applicability of the findings. While the benefits of bike fitting are well-documented, further investigations should focus on larger and more diverse groups of cyclists to establish universally applicable fitting protocols and examine long-term effects across various cycling disciplines. Expanding research in this field could provide a deeper understanding of how bike fitting influences sustained performance, efficiency, and injury prevention for cyclists of all levels.

CONCLUSIONS

1. Improvements in the 1-KM cycling time trial were most apparent after the participants completed the bike fitting, where their posttest scores significantly improved compared to their pretest scores.

2. The intervention of the Bike Fitters protocol helped improve body flexibility, posture, range of motion (upper, mid, and lower body), and balance. The device is viewed as moderately acceptable in terms of safety, with respondents expressing confidence in its safety for use as a therapist.

3. The results of the study showed a significant difference between the pretest and posttest measurements of the 1-KM cycling time trial after the participants underwent the bike fitting, indicating consistency with the study's objective.

4. The findings demonstrated that bike fitting is an effective medium for delivering an exercise program.

5. There is sufficient evidence to reject the null hypothesis that there is no significant difference between the pretest and posttest scores of the 1-KM cycling time trial after the implementation of the bike fitting.

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