

Static Bicycle Product Development in The Prevention of Non-Communicable Diseases of Urban Communities

Siti Nurul Fajriah^{1*}, Darwis Durahim², Muhammad Awal³, Supartina Hakim⁴, Nur Awalia Syahri Ramadhani⁵, Agussalim⁶,

^{1* 2, 3, 4, 5}Makassar School of Physiotherapy, Makassar Health Polytechnic, Ministry of Health Indonesian Republic, Makassar City, South Sulawesi, Indonesia.

⁶ Parepare School of Nursing, Makassar Health Polytechnic, Ministry of Health Indonesian Republic, Makassar City, South Sulawesi, Indonesia

Citation: Siti Nurul Fajriah et al (2024), Static Bicycle Product Development in The Prevention of Non-Communicable Diseases of Urban Communities *Educational Administration: Theory and Practice*, 30(6), 3227-3231
Doi: 10.53555/kuey.v30i6.6051

ARTICLE INFO

ABSTRACT

Non-communicable disease is still a burden for the country and society, urban society in particular. Doing physical activity regularly at least 30 minutes a day can be a good way to prevent and control the non-communicable incidence rate. In a busy urban society, less time to exercise, and even more access to the fitness centre are the complicated obstacles to having exercise, so a type of sport that is simple, easy, and safe while doing activities at home or work must be designed. In this case, we offer the use of a static bicycle. Therefore, we have to develop a static bicycle product that can be used for exercise while working at the office. This study aims to deliver static bicycle development to prevent non-communicable diseases in urban society. In this study, we used a Research and Development (R&D) method by involving 21 subjects who were diagnosed with non-communicable diseases to have a brainstorming discussion about product development. With all the subjects, we analysed and designed the static bicycle product into a prototype form using an Autodesk Inventor 2021 application. From the discussion about the design, we obtained the following results: the colour is black, made of carbon Fiber body (bar), the weight is 4 kg, the height is 418.04 cm, the 4-static bicycle base with Rubber footer and AS 1' support footer carbon Fiber anti-slip, energy source from batteries, length 1140.74 cm, width 399.42 cm, and a display monitor to the pulse, rpm, and distance measurement

Keywords: Autodesk Inventor 2021, Non-communicable disease, static bicycle, urban society

INTRODUCTION

Non-Communicable Disease (NCDs) are the diseases that cannot transmitted to the others such as heart disease, stroke, cancer, and diabetic. The progression of NCDs progresses slowly over a long period of time (chronic). In the early stages, NCDs often do not show symptoms, so they are not known and not realized. However, NCDs can cause serious problems because they require long-term treatment, incur high costs, reduce productivity, and pose a risk of fatality. The World Health Organization (WHO) states that the prevalence of NCDs as a cause of death worldwide increased from 61% in 2010 to 71% in 2016 (Kemenkes RI, 2019). The results of the Riskesdas in 2018 show an increase in key NCD indicators, including the prevalence of hypertension in individuals aged >18 years increasing from 25.8% to 34.1%, obesity in individuals aged >18 years increasing from 14.8% to 21.8%, smoking in individuals aged ≤18 years increasing from 7.2% to 9.1%, stroke in individuals aged ≥15 years increasing from 7 to 10.9 per thousand, cancer increasing from 1.4 to 1.8 per thousand, diabetes in individuals aged ≥15 years increasing from 6.9% to 10.9%, inadequate physical activity in individuals aged ≥10 years increasing from 26.1% to 33.5%, and inadequate fruit/vegetable consumption in individuals aged ≥5 years increasing from 93.5% to 95.5% (Kemenkes RI, 2018).

The cases of NCDs in Indonesia appear to be very concerning as the increasing trend of NCDs, which typically occurs in the elderly population, is now threatening the productive age group. This poses a higher risk to urban communities due to inactive and unhealthy lifestyles, which could have significant impacts on future generations of the nation. One key to preventing and controlling NCDs is by regularly engaging in exercise and physical activities. However, the busyness, time constraints, and access to sports facilities often become

obstacles to exercising regularly, so there is a need for simple, easy, and safe sports products for exercising while being active both at home and in the office. The sport that can be done is cycling using a static bicycle. Regular cycling can stimulate the cardiovascular, pulmonary, and musculoskeletal systems optimally. Cycling can increase energy levels by 20% and reduce fatigue by up to 65% because cycling can trigger the brain to release dopamine neurotransmitters, which causes blood circulation to flow smoothly and the body to feel refreshed with a moderate dose. Therefore, the aim of this research is to develop a static bicycle product to prevent NCDs in urban communities.

The objective of this study is to generate the development of a static bicycle product in preventing NCDs in urban communities. The process of developing the static bicycle product is conducted by analyzing the needs, examining the effects of developing the static bicycle product in preventing NCDs, and producing an output in the form of a prototype of the static bicycle product development.

The development of this static bicycle utilizes Autodesk Inventor 2021 application to design the product development based on ideas and innovations concluded in brainstorming activities, thus forming the basis for the resulting prototype design of the static bicycle product development (Farizal, 2020; Setiawan, 2019; Prabowo, 2018; Rachmawati, 2016). Subsequently, in the final stage, the production of the static bicycle prototype is carried out as the output of the research.

METHOD

The research method employed is Research and Development (R&D) with the very first steps starting from identifying potential issues and collecting data on the development of the static bicycle through brainstorming. The Research was conducted at the Ministry of Law and Human Rights, South Sulawesi Regional Office (*Kantor Kementerian Hukum dan HAM Regional Sulawesi Selatan*), specifically at the Sungguminasa Class II-A Women's Penitentiary Office (*Kantor Lembaga Masyarakat Perempuan Kelas II A*). The research sample consists of all Civil Servants detected to have NCDs during the Community Service activities carried out by the researchers.

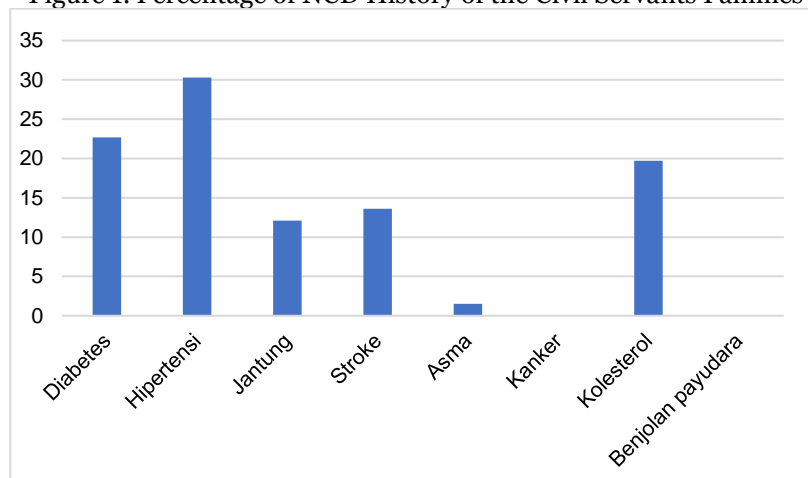
The activities conducted during the brainstorming session are as follows:

- Forming 4 groups and appointing the group leaders
- Informing the rules of brainstorming implementation
- Group leaders stating the initial issues
- Each group member given a few minutes to explore their ideas
- Each group member writes down their ideas
- Group members exchanging thoughts with each other
- Providing a short break for each group member to explore ideas
- Proposals from each group are collected and jointly evaluated
- Reaching an agreement on the proposed ideas in the development of the static bicycle

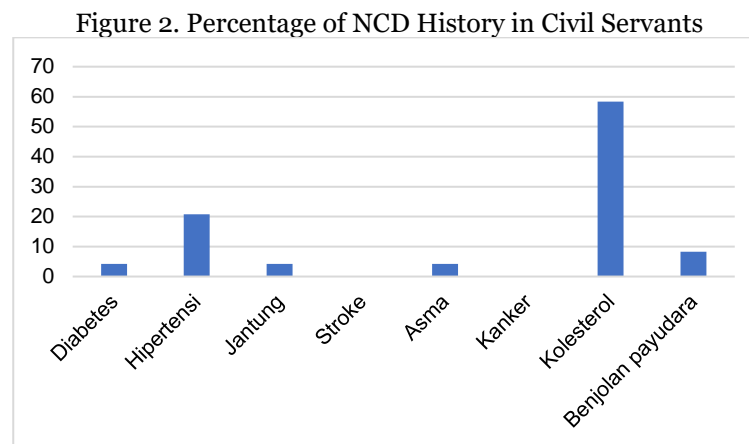
RESULT

The results of the observations conducted at the research site are as follows:

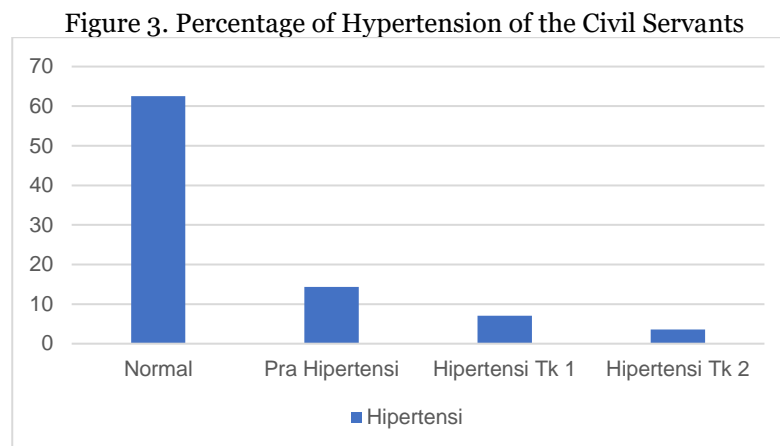
Figure 1. Percentage of NCD History of the Civil Servants Families



Based on the percentage of NCD history of the Civil Servants' families, it is shown that the history of hypertension has the highest percentage at 30.3%, followed by diabetes at 22.7% and stroke at 13.6%. This indicates that the issue of hypertension appears to contribute significantly to the existing morbidity rates, supported by unhealthy lifestyles which consequently lead to the occurrence of Diabetes and Stroke.



Furthermore, when looking at the percentage of NCD history among existing Civil Servants, it is found that the percentage of individuals with high cholesterol levels is the highest at 58.3%, followed by hypertension at 20.8% and diabetes at 4.2%. This provides an overview that in the productive population in urban areas, there are physiological changes contributing to the occurrence of NCDs. This condition is certainly influenced by the lifestyle adopted by urban communities, particularly related to dietary habits, physical activity, and supported by the rapid development of technology and science.



Specifically, Figure 3 shows that although the majority of Civil Servants are in a normal condition at 62.5%, there are Civil Servants experiencing pre-hypertension at 14.3%, Stage I hypertension at 7.1%, and Stage II hypertension at 3.6%. In this study, all Civil Servants experiencing NCDs, totaling 14 individuals, along with 7 other Civil Servants, making a total of 21 Civil Servants involved in the study.

DISCUSSION

The research on the development of static bicycle products that have been conducted is mostly aimed at sick individuals, including the design research of static bicycles for stroke patients which can maximize the stroke patient's rehabilitation process⁷. This research utilizes a static bicycle as an exercise tool for stroke patients to optimize the rehabilitation process, they undergo. Similarly, the design research of an adjustable mini static bicycle product for elderly individuals post-stroke resulted in 7 main functions and 3 additional functions; the color is black, made of iron material, with dimensions of 36 x 38 x 21 cm, the weight is 3 kg, designed for elderly individuals' post-stroke to train muscle coordination, powered by round batteries with a battery capacity of 270 mAH, with a maximum height adjustment of 60 cm. The pedal model is equipped with acupuncture, and an additional feature is a towel⁹.

This second study is more flexible as the static bicycle used is not only intended for stroke patients undergoing treatment but can also be used outside of treatment, allowing for further enhancement of physical activities¹¹. Similarly, research on static bicycles provided to asthma patients experiencing asthma exacerbations resulted in an increase in Peak Expiratory Flow (PEF) and a reduction in the frequency of asthma exacerbations. Furthermore, research on static bicycles for obese patients appears to produce significant changes in systolic blood pressure, while changes in diastolic blood pressure are not significant¹². The study on the design of standard static bicycles for stroke patients resulted in a product made of strong metal material that is portable, taking into consideration the strength to withstand loads, ergonomic aspects, and stability. The optimal weight is found in the backrest material, while the lightest weight in the backrest material corresponds to the additional function color¹³. In general, research on static bicycles conducted in several cases such as stroke,

asthma, and obesity seem to provide a fairly positive impact in the curative and rehabilitative efforts needed in those cases.

On the other hand, the development study of static bicycles aimed at healthy individuals can be seen in the research conducted at Gajah Mada University, where the integration of working with a laptop while pedaling a bicycle allows individuals to exercise while working as a form of concern for the lack of physical activity among the community⁸. This undoubtedly supports the importance of engaging in physical activities while performing work tasks. The results and discussions obtained from this research are as follows:

- Formation of 4 brainstorming groups consisting of 5-6 civil servants
- Presentation of brainstorming rules to ensure a conducive and calm brainstorming session, enabling each group member to articulate ideas for the development of static bicycles smoothly
- Researchers presented the initial problems and objectives of designing static bicycles to be used by urban communities during work, with several key development indicators requiring ideas such as color, material, weight, height, size, pedal model, bicycle legs, energy source, and additional bicycle functions
- Each group's brainstorming session lasted approximately 30 minutes to generate as many ideas as possible
- Ideas generated during the 30-minute session were then presented to the other 4 groups for feedback
- Based on the ideas and concepts presented, conclusions were drawn regarding the specific data on the development of static bicycle products for preventing non-communicable diseases in urban communities, as follows:
 - Color: black
 - Material: strong, sturdy, and lightweight iron
 - Weight: < 50 kg
 - Height: < 50 cm
 - Size: Width ± 40 cm, Height ± 50 cm, Length ± 50 cm
 - Pedal model: Width ± 10 cm, equipped with acupuncture
 - Bicycle basis: equipped with rubber
 - Energy source: battery
 - Additional functions: Timer, distance and heart rate monitor.

CONCLUSION

The development of a static bicycle product that can be used by the urban community during work to prevent non-communicable diseases among urban populations has been concluded.

RECOMMENDATION

The recommendation in this study is the need for expert validation of the existing prototype design of the static bicycle to assess the product's feasibility for use in the work environment of urban communities.

ACKNOWLEDGMENT

In the preparation of this journal, the author extends the utmost gratitude to all teams and collaborators involved. We also hope this journal can provide benefits to all.

FUNDING

There is no funding in this research

CONFLICT OF INTEREST

There is no conflict of interest

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The prototype of static bicycle product development

