Benefits of Nanogold Injections to Treat Rheumatism Arthritis Complaints: A Case Study on Covid19 Clinical Test Volunteers

Titik Taufikurohmah^{1*}, Rusmini Rusmini¹, and Djodjok Soepardjo²

¹Chemistry Department, Universitas Negeri Surabaya, Kampus Ketintang Surabaya, Indonesia

²Japanase Department, Universitas Negeri Surabaya, Kampus Lidahwetan Surabaya, Indonesia

Abstract. The reduction in rheumatoid arthritis was measured by the decrease in the diameter of the joint swelling expressed in percent. The Covid-19 status was obtained from the results of the PCR Swab. The results show that in general, COVID-19 volunteers with complaints of rheumatic arthritis are satisfied with nanogold injections because they reduce pain. Health in general; temperature, blood pressure and average heart rate during clinical trials within the normal ranges of healthy people. Volunteers for clinical trials during treatment were declared negative for COVID-19. It is proven that nanogold injections increase the immunity of Covid-19 volunteers with complaints of rheumatic arthritis. As for rheumatic arthritis complaints in general, all volunteers experienced a decrease. The decrease in swelling diameter of each volunteer differed from one another in the range of 20-36%. With reduced volunteers can stand straight, walk normally and no longer hurt when the joints are pressed.

Keywords: COVID-19, nanogold injections, rheumatic arthritis

1 Introduction

The use of nanogold has penetrated in various cases of disease. Including rheumatoid arthritis. Rheumatic arthritis is characterized by swelling in the joint area [1]. The joints are not only swollen but also painful when pressed. This is due to the accumulation of excess joint fluid. Not only the joint fluid that collects, but also the breakdown products of protein and free radicals that accompany this following activity [2]. Amino acids and lower protein degradation products CN⁻ are also present in the joint fluid of patients with rheumatoid arthritis. The accumulation of joint fluid and the increased volume of joint fluid cause disturbances [3]. This disorder is in the form of pain and tenderness when the joint is moved. This is because the accumulated joint fluid compresses the peripheral nerves in the joint area [4].

In this COVID-19 pandemic season, attention to people with rheumatoid arthritis needs to be done. In addition to being hit by fear of contracting COVID-19, they also experience rheumatic arthritis pain [5]. Clinical trials of nanogold injections were carried out on people exposed to COVID-19. This clinical trial aims to increase the community's immunity during the COVID-19 pandemic season. Some of the people exposed to COVID-19 have complaints of rheumatic arthritis. As many as 400 volunteers, 96 people with complaints of rheumatic

arthritis are of particular concern. In addition to dealing with exposure to the virus that causes COVID-19, they experience rheumatic arthritis. They have difficulty standing upright and walking normally due to joint inflammation [1]. Nanogold helps reduce joint fluid that causes swelling.

Nanogold is able to reduce free radicals, which are radical species formed during protein degradation [6]. Nanogold also binds to cyanide CN⁻ which is a toxin that irritates joints [7]. The cyanide binding by nanogold is very strong, which is characterized by a very large H_{Au}CN⁻ formation constant. This molecule found in sweat and urine is evidence of cyanide excretion. Free radical scavenging by nanogold has been studied in various studies [8]. Free radical scavenging by nanogold is 10 times that of free radical scavenging by vitamin E [9]. This strongly supports the application of nanogold to increase the immunity of volunteers in the covid19 pandemic season.

Nanogold increasing glutathione activity has also been reported as a result of research. Glutathione is an antioxidant that belongs to the body at the cellular level [10]. Increased glutathione activity is synonymous with increasing body immunity. Furthermore, cyanide toxins and free radicals are bound to nanogold and carried in the excretory system in both sweat and urine [11]. Thus the accumulation of cyanide toxins and free radicals is reduced during the treatment. Nanogold also repairs cell

* Corresponding author : titiktaufikurohmah@unesa.ac.id

damage that occurs by activating cell proliferation [12][13].

Nanogold has also been shown to increase collagen biosynthesis. Collagen is the main protein that makes up tissue. Collagen that is tight will support a strong network and is not easily broken and damaged [13]. With new healthy cells, old damaged and diseased cells leave the body. This gradual improvement has an impact on disease recovery so that volunteers with rheumatism experience a decrease in complaints until they are cured. Nanogold was originally used to treat rheumatoid arthritis [1]. Therefore, the injection of nanogold is expected to be a solution for rheumatoid arthritis sufferers in the covid19 pandemic season. It is very easy to recognize rheumatic arthritis experienced by volunteers. Rheumatoid arthritis is characterized by the physical inability of the body to stand up straight because of the pain. They cannot walk normally because the joints are swollen [14]. Measurement of joint diameter during treatment is a data reduction in rheumatic arthritis pain. In addition, it is also equipped with medical examinations and interviews how the joints are pressed. Is the joint still sore or no longer sore with a little pressure.

Nanogold injections are carried out every month from May to August. General Health Check-up; temperature, blood pressure and heart rate are carried out every month as well as checks for rheumatism, arthritis and covid19 status. The reduction in rheumatoid arthritis was measured by the decrease in the diameter of the joint swelling expressed in percent and completed with interview data. The Covid-19 status was obtained from the results of the PCR Swab [15].

2 Material and Method

Some of the people exposed to COVID-19 have complaints of rheumatic arthritis. People with rheumatic arthritis are characterized by not standing upright because of pain. They walk abnormally because the joints are swollen. As many as 400 volunteers, 96 people with complaints of rheumatic arthritis, became volunteers with special attention. Nanogold injections are carried out every month from May to August. General health checks for temperature, blood pressure and heart rate are carried out every month as well as checks for rheumatism, arthritis and COVID-19 status. The reduction in rheumatoid arthritis was measured by the decrease in the diameter of the joint swelling expressed in percent and in-depth interview data. Covid-19 status is obtained from PCR Swab results.

2.1 Material

The material used in this research is nanogold which is synthesized in sterile water media specifically for injection. The synthesis process uses the Button-Up method. The treatment of volunteers exposed to COVID-19 who suffer from rheumatic arthritis is prepared for special interviews and medical examinations. Those who suffer from rheumatic arthritis

are selected to be nanogold injection volunteers specifically.

2.1.1 Nanogold Synthesis

Synthesis of nanogold with a special medium, namely sterile water for injection fluids. Nanogold material is made from pure 24 carat gold metal dissolved in aqua regia. Every 1 gram of pure gold requires 8 ml of aqua regia. The gold solution formed was then diluted to 1000 ml. The result in the form of HAuCl_4 with a concentration of 1000 ppm (parts per million) was then used as the main synthesis solution.

The synthesis process begins by heating 980 ml of sterile specially injected water until it boils. Add 20 ml of mother liquor and 2 g of sodium citrate. Heating was continued until nanogold was formed. The nanogold formed is indicated by the change in the colour of the solution to red [16]. Heating was stopped and the nanogold was cooled. Nanogold is ready to be used as an injection material for clinical trials.

2.1.2 Arthritis Rheumatism Volunteer Selection

Volunteers are people exposed to COVID-19, namely the general public who live during the COVID-19 pandemic. Volunteers have a relatively equal chance of being exposed to COVID-19 and are considered the same as the general public. The selection of volunteers was done to pay special attention to cases of rheumatic arthritis. The selection of volunteers was based on physical characteristics and interviews about the arthritis he suffered. Physical characteristics are characterized by standing not upright, bending and enduring pain. Volunteers walk abnormally due to joint swelling disorders. The research team took a persuasive approach and opened a preliminary interview. After the acknowledgment of the volunteer being sick with rheumatic arthritis, it was confirmed by a medical examination by a team of doctors who had been prepared to support clinical trials. Volunteers were then given an explanation.

2.2 Implementation Methods of Clinical Test

The explanation to the volunteers was done before the clinical trial was conducted. The explanation includes the introduction of nanogold materials and the benefits of nanogold injections. Explanation of side effects and effects. All impacts will be borne by researchers and volunteers will be recovered in case of health problems. Volunteers are free to resign if it is deemed necessary. Volunteers who are ready to take part in clinical trials are required to follow the researcher's directions. Volunteers signed an agreement with the researcher. Volunteers receive adequate rewards and sign a consent form.

The clinical trial begins with a general medical examination; temperature, blood pressure, and heart rate. Measurement of the diameter of the swollen joints and intensive interviews related to rheumatism. Next,

inject nanogold on the volunteers' bodies. The injection is made uniformly, namely intramuscularly. Volunteers can choose whether the injection is in the upper arm or the hip. Volunteers are tested for COVID-19 and send the results to researchers. All tests were conducted once a month and the data were collected by the research team for analysis. Clinical trial May-August 2021 with complete data then analysed.

3 Result and Discussion

The results of the clinical trial of community volunteers exposed to COVID-19 with complaints of rheumatic arthritis are explained as follows:

1. Overall health temperature, blood pressure and heart rate were averaged during clinical trials within the normal ranges of healthy people. This can be seen in Table 1 and clarified by the figure in Figure 1. In Table 1. The average body temperature of volunteers from May to August did not change significantly. The average body temperature is in the range of healthy people, which is 36-38° Celsius. The average blood pressure of volunteers from May to August also did not experience significant changes. The average blood pressure is in the normal blood pressure range of a healthy person 100-120 mmHg. The volunteers' average heart rate also did not differ significantly from May to August. The average heart rate within the normal range of a healthy person is 60-100 beats per minute [17].
2. The recovery process of rheumatic arthritis can be observed in the data in table 1 and clarified in Figure 2. The decrease in the diameter of the swollen joints is an accurate data that describes the recovery process of rheumatic arthritis. Diameter during the clinical trial process compared to the initial diameter. In May, the decrease in DD was 20.3%, meaning that there was a decrease in joint swelling by an average of 96 volunteers by 20.3%. In June, July and August, the percent decrease was even greater, namely 25.7, 30.2 and 36.4, meaning that the joint diameter decreased and joint swelling decreased or deflated. This is very much in line with the reduction in pain represented by the hospital data. The number of volunteers who experienced pain when the joints were pressed from May to August fell. It can be seen in table 1. Hospital in May 82.2 percent of volunteers who hurt when the joints are pressed. The hospitalization process decreased significantly in June, July and August. In August, only 24.5% of the volunteers were still sick, meaning that more than 75% of the volunteers had recovered rheumatic arthritis [1].
3. Volunteer's covid19 status is exposed to covid19 from May to August in table 1 the price is 0. This means that volunteers are not infected with covid19 even though there is an opportunity to be exposed to covid19. This shows that the volunteers' immunity during clinical trials is maintained and even increased. Increased immunity can be seen

from the recovery process of rheumatoid arthritis experienced during clinical trials [12].

4. In-depth interviews with volunteers resulted in very high satisfaction. Volunteers are very happy with the nanogold injections, apart from reducing rheumatoid arthritis, the body feels fresh and energized. Joint pain when pressed decreases over time. They can stand up straight without pain. They also walk normally again [18]. The remaining 24.5% of volunteers are still sick but have greatly reduced compared to before. They feel the extraordinary in their joints. They feel much less pain and can rest in peace [19].

Table 1. Medical Record and Covid19 Status of Volunteer

Dat a	BT	BP	HR	DD	RS	CS
Mei	36,5 6	117,6	78,3	20,3	82,2	0
Jun e	36,5 3	116,2	82,1	25,7	62,1	0
July	36,5 7	118,3	79,2	30,2	40,3	0
Agu stus	36,6 6	118,1	81,3	36,4	24,5	0

BT = The Rate of Body Temperature (°C)
 BP = The Rate of Body Pressure (mmHg)
 HR = The Rate of Heart Rate (number/minute)
 DD= Diameter Decrease of swollen joint (%)
 RS= Rheumatic Arthritic Status (%)
 CS = Covid19 Status (%)

Medical record data in table 1 BT, BP and HR is the average data from 96 clinical trial volunteers. The DD is the average decrease in joint diameter of 96 volunteers expressed in percent. The value is obtained from measuring the joint diameter compared to the initial joint diameter multiplied by 100%. The hospital is the percentage of volunteers who still feel pain when the joints are pressed. This value is obtained by calculating the number of sick people divided by the total number of volunteers (96 people) times 100 percent [15][20].

Fig 1. The Medical Record of Volunteer

Decreased joint diameter indicates reduced joint fluid in rheumatic arthritis. This is in accordance with the theory developed from previous research. In the case of rheumatic arthritis, the joints experience swelling

[21]. Joint fluid increases in volume due to the accumulation of protein degradation into amino acids, free radicals and cyanide toxins. The increased amount of joint fluid triggers swelling and pain due to compression of the nerves and swollen joints [18]. This is also experienced by COVID-19 volunteers who are sick with rheumatic arthritis.

Nanogold interacts with CN⁻ cyanide and carries it into the body's excretory system. Likewise, the ability of nanogold to reduce free radicals and carry them in the body's excretory system [1]. It is strongly supported by the fact that the pain in the joints decreases gradually. This is also felt by clinical trial volunteers. The removal of free radicals from the body reduces the damage that occurs. Because free radicals are always attacking and damaging the surrounding cells. With reduced free radicals, tissue recovery occurs more quickly [6].

Fig 2. The Recovery Process Rheumatic Arthritis.

Nanogold also increases cell proliferation which is very helpful in the formation of new tissue [13]. Nanogold also increases the biosynthesis of collagen which is a type of protein [22]. With the new protein building formed, tissue damage is immediately restored [23]. With nanogold injections the tissue damage in the joints is gradually recovered and the pain is reduced. This is the process of recovering from rheumatoid arthritis, which is also experienced by clinical trial volunteers. This can be seen in Figure 2. Where the percentage of DD diameter decreases there is an increase from May to August. Decreased diameter means that the joint swelling is reduced to no swelling or recovering from rheumatic arthritis. Likewise, the rheumatic arthritis status of the hospital decreased to less than 25%. This shows that 25% of the volunteers who are still sick are even less than 25%.

4 Conclusion

Volunteers for clinical test during treatment were declared negative for COVID-19. This means that the immunity of volunteers during clinical trials is stable or even increased. Nanogold is proven to increase the immunity of volunteers in clinical test. The results showed that in general, COVID-19 volunteers with complaints of rheumatic arthritis were satisfied with the nanogold injection clinical test because they succeeded in reducing pain complaints until they healed. It is proven that nanogold injections reduce complaints of

rheumatic arthritis to cure sick volunteers in the covid19 pandemic season. Nanogold can be relied upon to recover from rheumatic arthritis in the COVID-19 pandemic season and beyond. Nanogold has potential for future drugs for rheumatic arthritis.

Thank you to the Ministry of Education and Culture through the Director General of Higher Education who has provided funding for the Research Development scheme with a master contract number; 217/SP2H/LT/DRPM/2021 and derivative contract numbers; B/12102/UN38.9/LK.04.00/2021. Thank you to the State University of Surabaya through the Institute for Research and Community Service LPPM for taking care of the disbursement of research funds and conducting research administration.

References

- [1] T. Taufikurohmah, R. Rusmini, and D. Soepardjo, "Aplication of nanogold and nanosilver to reduce rheumatic arthritis: Case study at leprosy patients," *J. Phys. Conf. Ser.*, vol. **1869**, no. 1, (2021).
- [2] C. Y. Tsai *et al.*, "Amelioration of collagen-induced arthritis in rats by Nanogold," *Arthritis Rheum.*, vol. **56**, no. 2, pp. 544–554, (2007).
- [3] N. M. Sosibo, F. K. Keter, A. Skepu, R. T. Tshikhudo, and N. Revaprasadu, "Facile Attachment of TAT Peptide on Gold Monolayer Protected," pp. 1211–1222, (2015).
- [4] Y. Lin, Q. Zhou, Y. Lin, D. Tang, R. Niessner, and D. Knopp, "Enzymatic Hydrolysate-Induced Displacement Reaction with Multifunctional Silica Beads Doped with Horseradish Peroxidase-Thionine Conjugate for Ultrasensitive Electrochemical Immunoassay," *Anal. Chem.*, vol. **87**, no. 16, (2015).
- [5] T. A. Novitasari, "The Effect of Nanogold-Nanosilver for Immune Enhancement of Drug Abuse Victims in Areas Affected by COVID-19," *Int. J. Curr. Sci. Res. Rev.*, vol. **04**, no. 01, pp. 32–39, (2021).
- [6] D. S. Hsieh, H. C. Lu, C. C. Chen, C. J. Wu, and M. K. Yeh, "The preparation and characterization of gold-conjugated polyphenol nanoparticles as a novel delivery system," *Int. J. Nanomedicine*, (2012).
- [7] F. K. Alanazi, A. A. Radwan, and I. A. Alsarra, "Biopharmaceutical applications of nanogold," *Saudi Pharmaceutical Journal*. (2010).
- [8] H. Li, S. H. Park, J. H. Reif, T. H. LaBean, and H. Yan, "DNA-Templated Self-Assembly of Protein and Nanoparticle Linear Arrays," *J. Am. Chem. Soc.*, (2004).
- [9] E. G. Victor *et al.*, "Pulsed ultrasound associated with gold nanoparticle gel reduces oxidative stress parameters and expression of pro-inflammatory molecules in an animal model of muscle injury," *J. Nanobiotechnology*, (2012).
- [10] Q. Zheng, H. Yang, J. Wei, J. long Tong, and Y.

- qian Shu, "The role and mechanisms of nanoparticles to enhance radiosensitivity in hepatocellular cell," *Biomed. Pharmacother.*, (2013).
- [11] S. Pentyala, J. Muller, T. Tumillo, A. Roy, P. Mysore, and S. Pentyala, "A Novel Point-of-Care Biomarker Recognition Method: Validation by Detecting Marker for Diabetic Nephropathy," pp. 177–188, (2015).
- [12] P. Mukherjee *et al.*, "Antiangiogenic properties of gold nanoparticles," *Clin. Cancer Res.*, 2005.
- [13] T. Taufikurohmah, I. M. Sanjaya, A. Baktir, and A. Syahrani, "Synthesis of Nanogold and Stability Test of This Colloidal as Essential Material in Drug , Supplement and Cosmetics," vol. **3**, no. 5, pp. 2012–2015, (2014).
- [14] I. Cieřlik, E. Cieřlik, I. Mentel, and K. Bartyzel, "Therapeutic activity of mangosteen fruits (*Garcinia mangostana* L.)," *Postep. Fitoter.*, (2017).
- [15] Y. Cui *et al.*, "Nanogold-polyaniline-nanogold microspheres-functionalized molecular tags for sensitive electrochemical immunoassay of thyroid-stimulating hormone," *Anal. Chim. Acta*, (2012).
- [16] R. D. Powell and J. F. Hainfeld, "Preparation and high-resolution microscopy of gold cluster labeled nucleic acid conjugates and nanodevices," *Micron*. (2011).
- [17] F. Ruiz-Ruiz, E. I. Mancera-Andrade, R. Parra-Saldivar, T. Keshavarz, and H. M. N. Iqbal, "Drug Delivery and Cosmeceutical Applications of Poly- Lactic Acid Based Novel Constructs - A Review," *Curr. Drug Metab.*, (2018).
- [18] J. L. Rodríguez-Chávez *et al.*, "Mexican Arnica (*Heterotheca inuloides* Cass. Asteraceae: Astereae): Ethnomedical uses, chemical constituents and biological properties," *Journal of Ethnopharmacology*. (2017).
- [19] T. Taufikurohmah, "Synthesis and Characterization of Nanogold and Nanosilver as Leprosy Drug Candidates and Their Activity Tests in Leprosy Patients ; Case Study," vol. **95**, no. Miscic, pp. 22–27, (2019).
- [20] M. Hussain *et al.*, "Cefuroxime derived copper nanoparticles and their application as a colorimetric sensor for trace level detection of picric acid," *RSC Adv.*, vol. **6**, no. 86, (2016).
- [21] D. Peck, "Prometheus Missing. Critical Materials and Product Design," (2016).
- [22] C. L. Brown *et al.*, "Nanogold-pharmaceutics," *Gold Bull.*, (2007).
- [23] B. A. Katsnelson *et al.*, "Comparative in vivo assessment of some adverse bioeffects of equidimensional gold and silver nanoparticles and the attenuation of nanosilver's effects with a complex of innocuous bioprotectors," *Int. J. Mol. Sci.*, vol. **14**, no. 2, pp. 2449–2483, (2013).