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Community-based metabolic syndrome screening and herbal beverage training: An intervention in Parepare, Indonesia

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ABSTRACT

The prevalence of metabolic syndrome in Indonesia continues to increase, while community-based preventive interventions that integrate early screening and nonpharmacological approaches remain limited. This community engagement program aimed to enhance the capacity of Aisyiyah cadres in Parepare City through training on metabolic syndrome screening and the preparation of herbal beverages as a preventive strategy. A participatory training method was applied, including preparation, socialization, lectures, demonstrations, hands-on practice, mentoring, and evaluation using pre-test and post-test designs. The training focused on improving cadres' knowledge, attitudes, and skills related to metabolic syndrome risk factors, basic screening procedures, and the utilization of local herbal ingredients. The results showed a marked improvement in participants' competencies. Before the intervention, most cadres had low levels of knowledge (44%) and moderate attitudes (36%). After the training, the majority demonstrated good knowledge (80%) and positive attitudes (64%). Follow-up evaluation indicated that cadres actively disseminated the information to the community and began promoting healthier lifestyles supported by herbal-based practices. These findings show that community-based training strengthens the role of women health cadres in preventing metabolic syndrome. Integrating herbal beverage preparation adds value by supporting sustainable health promotion and economic empowerment, especially in rural communities.

ABSTRAK

Prevalensi sindrom metabolik di Indonesia terus meningkat, sementara intervensi pencegahan berbasis komunitas yang mengintegrasikan skrining dini dan pendekatan nonfarmakologis masih terbatas. Program keterlibatan komunitas ini bertujuan untuk meningkatkan kapasitas kader Aisyiyah di Kota Parepare melalui pelatihan tentang skrining sindrom metabolik dan persiapan minuman herbal sebagai strategi pencegahan. Metode pelatihan partisipatif diterapkan, meliputi persiapan, sosialisasi, ceramah, demonstrasi, praktik langsung, bimbingan, dan evaluasi menggunakan desain pre-test dan post-test. Pelatihan berfokus pada peningkatan pengetahuan, sikap, dan keterampilan kader terkait faktor risiko sindrom metabolik, prosedur skrining dasar, dan pemanfaatan bahan herbal lokal. Hasil menunjukkan peningkatan signifikan dalam kompetensi peserta. Sebelum intervensi, sebagian besar kader memiliki tingkat pengetahuan yang rendah (44%) dan sikap yang moderat (36%). Setelah pelatihan, mayoritas menunjukkan pengetahuan yang baik (80%) dan sikap yang positif (64%). Evaluasi lanjutan menunjukkan bahwa petugas kesehatan aktif menyebarkan informasi kepada masyarakat dan mulai mempromosikan gaya hidup sehat yang didukung oleh praktik berbasis herbal. Temuan ini menunjukkan bahwa pelatihan berbasis komunitas memperkuat peran kader kesehatan perempuan dalam pencegahan sindrom metabolik. Integrasi pembuatan minuman herbal memberi nilai tambah melalui promosi kesehatan berkelanjutan dan pemberdayaan ekonomi, khususnya di wilayah pedesaan.

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INTRODUCTION

Metabolic syndrome (MetS) has become a major global public health concern, including in Indonesia, due to its strong association with cardiovascular disease and type 2 diabetes mellitus. It is characterized by a cluster of interrelated risk factors—central obesity, hypertension, dyslipidemia, and insulin resistance—that collectively increase morbidity and mortality from non-communicable diseases (Rochlani et al., 2017). Epidemiological evidence indicates a steady rise in MetS prevalence in Indonesia over the past decade, largely driven by rapid lifestyle transitions. Recent data show that MetS affects 28% of men and 46% of women, with hypertension as the most dominant component, present in approximately 60% of cases (Nabila & Mudjihartini, 2022). This increasing burden substantially contributes to the escalation of degenerative diseases and strains the national health system.

Regional evidence indicates that South Sulawesi has a relatively high prevalence of MetS components, influenced by unhealthy dietary patterns characterized by excessive intake of sugar, salt, and fat, combined with low physical activity levels (Yusni & Meutia, 2020). Central obesity among middle-aged adults has been identified as a key determinant of MetS risk in Indonesia (Sigit et al., 2020). Lifestyle-related factors, including poor dietary quality, high sodium consumption, sedentary behavior, and psychosocial stress, further exacerbate metabolic health outcomes (Suhaema & Masthalina, 2015; Chen et al., 2020; Khairani et al., 2019; Prabawa et al., 2019). Despite these risks, public awareness and early detection remain limited due to inadequate screening at primary care and community levels, underscoring the need for comprehensive, community-based promotive and preventive interventions (Pérez-Martínez et al., 2017; Munawaroh et al., 2023).

Scientific evidence consistently shows that lifestyle modification interventions focusing on healthy diets, regular physical activity, and stress management effectively reduce the risk of MetS. Dietary approaches emphasizing increased fiber intake, reduced sodium consumption, and balanced macronutrients improve blood pressure, lipid profiles, and insulin sensitivity (Suhaema & Masthalina, 2015; Nugraha & Inayah, 2020). Community-based physical activity programs have also demonstrated benefits in reducing central obesity and improving metabolic parameters (Nunggraeni & Sulchan, 2015; Eff et al., 2022).

In addition to behavioral strategies, traditional herbal medicine has gained attention as a complementary, nonpharmacological approach to preventing metabolic disorders. Indonesia's biodiversity provides various medicinal plants with antioxidant and metabolic-regulating properties, including ginger, turmeric, roselle, kencur, and moringa (Yusni & Meutia, 2020; Mahmudah et al., 2023). Herbal interventions are widely accepted in communities and may complement modern pharmacotherapy; however, their effectiveness depends on adequate knowledge of preparation, dosage, and safety (Malini et al., 2023; Herman et al., 2024).

Despite supporting evidence, most interventions remain fragmented, focusing either on lifestyle change or herbal use without integrating early metabolic screening. Limited studies have explored the role of trained community cadres in delivering combined screening and herbal education, particularly in South Sulawesi (Sigit et al., 2020). Therefore, this study introduces an integrated community empowerment model led by Aisyiyah cadres, combining metabolic syndrome screening with herbal beverage preparation. The study aims to enhance cadres' knowledge, attitudes, and skills to strengthen sustainable, promotive, and preventive health interventions at the community level.

METHODS

This community service activity applied a health education approach based on training and hands-on practice, with Aisyiyah cadres in Parepare City as the primary participants. A participatory method was adopted, positioning the cadres not only as trainees but also as key actors in implementing and disseminating the program within their respective communities.

The program was conducted through several sequential stages. The preparation stage involved coordination with the Aisyiyah leadership of Parepare City to determine the activity location,

number of participants, and logistical requirements. Training modules were developed covering metabolic syndrome, simple screening techniques, and herbal beverage preparation. These modules were prepared based on recent literature and official guidelines on the prevention of non-communicable diseases.

The socialization stage aimed to introduce the objectives, benefits, and activity plan to the cadres, fostering commitment and readiness to participate fully while emphasizing their role as agents of change in the community. This was followed by training on metabolic syndrome screening, during which cadres were trained to conduct basic assessments of metabolic risk factors, including blood pressure measurement, body mass index calculation, waist circumference measurement, and brief interviews on medical history and lifestyle behaviors. The training employed interactive lectures, demonstrations, and supervised hands-on practice using simple measuring tools to ensure cadres' competency in conducting independent screening.

Subsequently, cadres received training in herbal beverage preparation using locally available plants with potential benefits for metabolic health, such as ginger, turmeric, cinnamon, moringa leaves, lime, and honey. Practical sessions emphasized safety, hygiene, and appropriate consumption dosages, enabling cadres to apply herbal knowledge in the form of health-promoting beverages.

Post-training mentoring and monitoring were conducted through periodic meetings, group discussions, and field supervision to support cadres in applying screening and health education activities within their communities. Program evaluation was carried out using pre-test and post-test assessments to measure changes in knowledge and skills, complemented by direct observation of screening practices and herbal beverage preparation. Data from assessments and observations were analyzed descriptively to evaluate improvements in knowledge, attitudes, and skills. The main indicators of program success included increased cadre competence and their ability to disseminate metabolic syndrome prevention messages to the wider community.

Figure 1
Several stages of activity implementation

Note: (a) Presentation of material on Metabolic Syndrome Screening; b) Demonstration of Metabolic Syndrome Screening; c) Presentation of material on Making Herbal Drinks; d) Training on Making Herbal Drinks.

RESULTS AND DISCUSSION

Figure 1 shows several stages of activities carried out, including pre- and post-test measurements, material delivery and demonstrations, and follow-up evacuation. To improve participants' understanding, the activities were supplemented with training modules. The provision of modules was intended to make it easier for participants to reread any material that was not fully understood. After the pre-test measurements were taken, the first material was about metabolic syndrome screening. The activity then continued with a demonstration of how to perform the screening. After that, the next material was about how to make herbal drinks. The stages carried out were the same as in the metabolic screening material. The making of herbal drinks began with the delivery of material, followed by a demonstration of how to make herbal drinks. During the material delivery process, the participants appeared enthusiastic about the material provided. After the material delivery and demonstration were completed, a post-test measurement and follow-up plan were carried out.

The training results showed an increase in respondents' knowledge and attitudes toward metabolic syndrome screening and herbal drinks. Before the training, most of the cadres' knowledge was in the poor category (44%), and after the training, most were in the good category (80%). Similarly, before the training, most attitudes were in the fair category (60%), and after the training, most were in the good category (64%) (See Figure 2).

After three months of implementation, an evaluation was conducted to assess the follow-up actions taken by the cadres (see Figure 3). The evaluation results showed that the cadres had disseminated the training materials to other cadres in their areas, both through counseling activities and demonstrations on how to make herbal drinks. However, there were also cadres who had not yet had the opportunity to disseminate the training materials they had received to other cadres, but had consistently applied the training materials in their daily lives, for example by adopting a healthy lifestyle, balanced nutrition, regular physical activity, and regularly consuming homemade herbal remedies. The herbal remedies made were decoctions of breadfruit leaves and cinnamon. Some also made moringa and ginger drinks.

The training program implemented among Aisyiyah cadres in Parepare City demonstrated a significant improvement in knowledge and attitudes related to metabolic syndrome and the use of herbal beverages as preventive measures. Pre-test results indicated that most cadres were initially categorized as having low levels of knowledge and attitudes; however, after the training, the majority showed substantial improvement, with the largest proportion reaching the good category. These findings are consistent with previous studies emphasizing that health education–based training is an effective strategy for strengthening the capacity of community health cadres (Kinanti et al., 2021; Nuriannisa et al., 2023).

Figure 2
Changes in cadres' knowledge and attitudes, before and after training

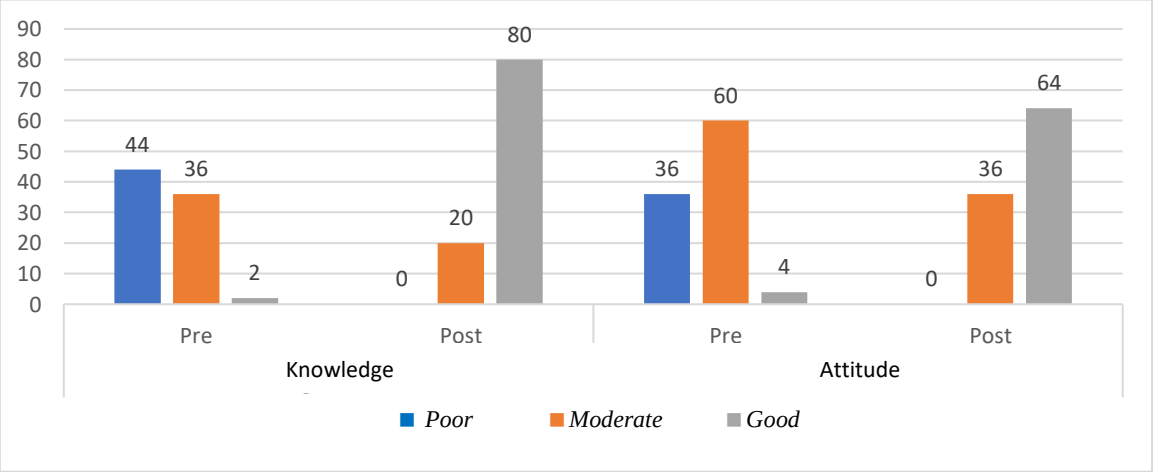

Figure 3
Evaluation of the implementation of the follow-up plan by training participants

The effectiveness of the training can be viewed from two main aspects. First, cadres' knowledge of metabolic syndrome increased markedly. Before the training, many cadres had limited understanding of key risk factors, including central obesity, hypertension, dyslipidemia, and insulin resistance. Following the intervention, 80% of cadres achieved a good level of knowledge, indicating that the integration of lectures, interactive discussions, and simple screening practice effectively enhanced comprehensive understanding. Improved knowledge provides a strong foundation for cadres to deliver accurate health education to the community (Sholekhah et al., 2024).

Second, cadres' attitudes toward metabolic syndrome prevention also improved substantially. Prior to the training, only a small proportion of cadres demonstrated positive attitudes. After the intervention, 64% were classified in the good category, with no cadres remaining in the low category. This finding suggests that the training influenced not only cognitive knowledge but also positive attitudinal change, which is essential for implementing promotive and preventive behaviors at the community level (Sofyanita & Wikandari, 2023).

These results support previous evidence that early screening programs are effective in reducing the risk of metabolic syndrome complications by increasing awareness of key risk factors such as waist circumference, blood pressure, and blood glucose levels (Nuriannisa et al., 2023). Integrating screening with nutrition education and herbal utilization offers a dual preventive effect, as healthy dietary interventions rich in fruits, vegetables, and antioxidants have been shown to reduce metabolic syndrome risk across age groups (Prihaningtyas et al., 2020; Yulistianingsih & Firdaus, 2023).

The use of traditional herbal medicine emerged as an important nonpharmacological component of this program. Cadres were trained to prepare herbal beverages using locally available ingredients such as ginger, turmeric, cinnamon, and moringa leaves, which possess anti-inflammatory, antioxidant, and antihyperglycemic properties. This approach not only strengthens community-based prevention strategies but also aligns with global trends promoting natural therapies. Moreover, herbal beverage training creates opportunities for household-level economic empowerment through community-based health product development (Malini et al., 2023).

The success of this program was further supported by the strong role of Aisyiyah as a community organization with an extensive cadre network. Previous studies have shown that Aisyiyah cadres play a crucial role in motivation, early detection, and health education at the local level, thereby ensuring program sustainability through continuous knowledge transfer (Kristinawati et al., 2024; Jihad et al., 2022).

Several supporting factors contributed to the program's success, including the participatory training method combining theory and practice, the relevance of the topic to local health needs, and the integration of health promotion with local wisdom through herbal utilization. Nevertheless, several challenges remain, such as the need for continued mentoring for cadres who did not achieve

optimal competency and the limited evidence regarding the long-term effectiveness of herbal beverage consumption. External factors, including local policy support, availability of health facilities, and resource sustainability, will also influence the potential for broader program replication (Citrakesumasari, 2020).

Overall, these findings confirm that the integration of simple screening, nutrition education, and local herbal utilization through the empowerment of Aisyiyah cadres is effective in improving cadre knowledge and attitudes and holds strong potential for reducing metabolic syndrome prevalence in the community. This strategy not only strengthens community health resilience but also supports local economic empowerment. Future programs should be expanded with stronger policy support, further research, and multisectoral collaboration to ensure greater and more sustainable impact.

CONCLUSION

This community service program, implemented through training on metabolic syndrome screening and herbal beverage preparation among Aisyiyah cadres in Parepare City, was effective in strengthening cadre capacity. Evaluation results demonstrated a significant improvement in both knowledge and attitudes, with most cadres shifting from low to good categories after the training. These findings confirm that a participatory, practice-oriented training approach can positively enhance the competencies of community health cadres. The integration of simple metabolic syndrome screening education with the utilization of local herbal plants represents a comprehensive strategy for prevention. This approach not only improved cadres' understanding and skills but also facilitated broader community application and opened opportunities for household-level economic empowerment through the production of herbal health beverages.

Supported by the strong organizational network of Aisyiyah, the success of this program highlights the relevance and effectiveness of community-based interventions in reducing the risk of metabolic syndrome. To ensure sustainability and broader impact, future efforts should include continuous mentoring, stronger local policy support, and further research to assess the long-term effectiveness of herbal utilization and community-based preventive interventions.

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AUTHORS' CONTRIBUTION

Nurhaedar Jafar contributed to program design, provided expertise in nutrition and metabolic syndrome, and reviewed the manuscript. Anna Khuzaimah supported the development of training modules and assisted in educational delivery and data documentation. Muhammad Asfar contributed to the practical training components, particularly in herbal beverage preparation, and assisted with field implementation. Yessy Kurniati conceptualized the community service program, coordinated stakeholder engagement, supervised implementation activities, and led the drafting and revision of the manuscript.

COMPETING INTEREST

The author(s) declare no potential conflict of interest with respect to the research, authorship, or publication

REFERENCES

Aisyah, P., Febrita, S., & Hidayat, Y. (2020). Pemberdayaan kader kesehatan masyarakat dalam perawatan paliatif di wilayah kerja puskesmas babakan sari kota bandung. *Intervensi Komunitas*, 1(2), 141-147. https://doi.org/10.32546/ik.v1i2.645

Arimbawa, E. (2022). Sosialisasi penggunaan leaflet dalam peningkatan pemahaman penggunaan obat herbal untuk penyakit kronis di kota denpasar. *Prima Portal Riset Dan Inovasi Pengabdian Masyarakat*, 1(2), 31-38. https://doi.org/10.55047/prima.v1i2.169

Asrizal, C. and Farrastama, M. (2021). Hubungan tingkat pengetahuan dan tingkat aktivitas fisik sebagai pencegah sindrom metabolik. *Jurnal Kedokteran Syiah Kuala*, 21(2). https://doi.org/10.24815/jks.v21i2.20566

Chen, D., Ye, Z., Shao, J., Tang, L., Zhang, H., Wang, X., & Zhang, Q. (2020). Effect of electronic health interventions on metabolic syndrome: a systematic review and meta-analysis. *BMJ Open*, 10(10), e036927. https://doi.org/10.1136/bmjopen-2020-036927

Citrakesumasari., Kurniati, Y., Syam, A., Salam, A., & Virani, D. (2020). Pencegahan stunting melalui pemberdayaan kader pkk kecamatan barebbo di kabupaten bone. *Panrita Abdi - Jurnal Pengabdian Pada Masyarakat*, 4(3), 322. https://doi.org/10.20956/pa.v4i3.8083

Eff, A., Rahayu, S., & Lena, A. (2022). Upaya pencegahan penyakit sindrom metabolik sejak remaja. *Jurnal Pengabdian Masyarakat Indonesia*, 2(3), 255-260. https://doi.org/10.52436/1.jpmi.612

F, A. and Sulchan, M. (2015). Pengaruh konseling modifikasi gaya hidup terhadap penurunan asupan natrium, tekanan darah, dan kadar c-reactive protein (crp) pada remaja obesitas dengan sindrom metabolik. *Journal of Nutrition College*, 4(3), 300-307. https://doi.org/10.14710/jnc.v4i3.10097

Herman, H., Faisal, M., Almeida, M., Helmi, H., Arief, M., Iswahyudi, I., & Maulidya, V. (2024). Edukasi pemanfaatan herbal dan upaya pencegahan dan penanganan penyakit degeneratif di kelurahan teluk pemedas, samboja, kutai kartanegara. *Jurnal Pengabdian Dan Pengembangan Masyarakat Indonesia*, 3(1), 1-7. https://doi.org/10.56303/jppmi.v3i1.238

Irianto, I., Susandy, V., & Mardiyaningsih, A. (2022). Studi tingkat pengetahuan dan pola penggunaan obat tradisional sebagai terapi komplementer penyakit degeneratif di kauman nganjuk. *Jurnal Jamu Kusuma*, 2(2), 64-75. https://doi.org/10.37341/jurnaljamukusuma.v2i2.38

Jihad, M., Kurnia, A., Handari, A., Sari, D., Andriani, S., Kusuma, A., & Wiji, E. (2022). Penanggulangan penyakit degenaratif di rw 8 kelurahan kedungmundu kecamatan tembalang kota semarang. *Saluta Jurnal Pengabdian Kepada Masyarakat*, 2(1), 27. https://doi.org/10.26714/sjpkm.v2i1.12949

Kautsar, A., Mulia, V., Suryawati, S., Andayani, H., Perdana, N., Suardi, H., & Aini, Z. (2022). Pengetahuan dan sikap tentang penggunaan herbal oleh geriatri di banda aceh. *Jurnal Kedokteran Syiah Kuala*, 22(1). https://doi.org/10.24815/jks.v22i1.23882

Khairani, A., Nurhasanah, N., Rahman, P., Septrina, R., Nurhayati, T., Luftimas, D., & Ramdhani, M. (2019). The profile of eating habit and physical activity in preventing metabolic syndrome. *Jurnal Pendidikan Jasmani Dan Olahraga*, 4(1). https://doi.org/10.17509/jpjo.v4i1.15069

Kinanti, R., Masriadi, M., & Gobel, F. (2021). Faktor yang berhubungan dengan sindrom metabolik (hipertensi dan dm tipe 2) di puskesmas perawatan siko kota ternate. *Window of Public Health Journal*, 1153-1162. https://doi.org/10.33096/woph.v2i3.288

Kristinawati, B., Latiifah, I., Wijayanti, N., Mardana, N., Pratama, R., & Asyfiradayati, R. (2024). Pembinaan dan pendampingan kader kesehatan nasyiatul aisyiyah dan aisyiyah dalam deteksi dini penyakit melalui cek kesehatan. *JMM (Jurnal Masyarakat Mandiri)*, 8(1), 740. https://doi.org/10.31764/jmm.v8i1.20430

Mahmudah, R., Isrul, M., Pusmarani, J., & Fauziyah, R. (2023). Pelatihan budidaya tanaman herbal di desa puasana, kecamatan moramo utara, kabupaten konawe selatan, sulawesi tenggara. *Jurnal Mandala Pengabdian Masyarakat*, 4(2), 598-602. https://doi.org/10.35311/jmpm.v4i2.326

Malini, D., Setiawati, T., & Alipin, K. (2023). Sosialisasi pemanfaatan tanaman herbal sebagai obat akternatif penyakit radang sendi. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (Pkm)*, 6(4), 1630-1644. https://doi.org/10.33024/jkpm.v6i4.9682

Munawaroh, S., Yunita, F., BR, R., Ashma, A., Savitri, A., Al-Shoud, A., & Susanti, E. (2023). Edukasi pencegahan sindroma metabolik sebagai upaya peningkatan derajat kesehatan masyarakat. *Smart Society Empowerment Journal*, 3(1), 19. https://doi.org/10.20961/ssej.v3i1.71251

Nabila, C. and Mudjihartini, N. (2022). Correlation between fructose consumption habits and insulin resistance with tyg index biomarkers manifesting metabolic syndrome at the elderly monjok integrated services post (posyandu). *Asian Journal of Medicine and Health*, 77-87. https://doi.org/10.9734/ajmah/2022/v20i12772

Nugraha, D. and Inayah, I. (2020). Penapisan dan pencegahan sindroma metabolik pada masyarakat di kecamatan tambang kabupaten kampar. *Jurnal Pandu Husada*, 1(4), 211. https://doi.org/10.30596/jph.v1i4.5360

Nunggraeni, D. and Sulchan, M. (2015). Pengaruh konseling modifikasi gaya hidup terhadap asupan kolesterol, kadar kolesterol high density lipoprotein (hdl), dan kadar c-reactive protein (crp) pada remaja obesitas dengan sindrom metabolik. *Journal of Nutrition College*, 4(3), 271-280. https://doi.org/10.14710/jnc.v4i3.10093

Nuriannisa, F., Wulandari, C., Mutiarani, A., Setiarsih, D., Salamy, A., Aini, Z., & Wulansari, A. (2023). Peningkatan kapasitas kader desa masangan kulon melalui orientasi pengukuran lingkar pinggang sebagai upaya skrining sindrom metabolik dewasa. *Prosiding Seminar Nasional Pengabdian Kepada Masyarakat*, 3(1), 422-428. https://doi.org/10.33086/snpm.v3i1.1273

Pérez-Martínez, P., Mikhailidis, D., Athyros, V., Bulló, M., Couture, P., Covas, M., & López-Miranda, J. (2017). Lifestyle recommendations for the prevention and management of metabolic syndrome: an international panel recommendation. *Nutrition Reviews*, 75(5), 307-326. https://doi.org/10.1093/nutrit/nux014

Prastika, B., Pradine, R., & Armini, N. (2019). Analisis hubungan gaya hidup dengan kualitas hidup wanita pasangan subur akseptor kb iud. *Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery)*, 6(2), 227-234.

https://doi.org/10.26699/jnk.v6i2.art.p227-234

Prihaningtyas, R., Widjaja, N., Hanindita, M., & Irawan, R. (2020). Diet dan sindrom metabolik pada remaja obesitas. *Amerta Nutrition*, 4(3), 191. https://doi.org/10.20473/amnt.v4i3.2020.191-197

Rochlani, Y., Pothineni, N., Kovelamudi, S., & Mehta, J. (2017). Metabolic syndrome: pathophysiology, management, and modulation by natural compounds. *Therapeutic Advances in Cardiovascular Disease*, 11(8), 215-225. https://doi.org/10.1177/1753944717711379

Sigit, F., Tahapary, D., Trompet, S., Sartono, E., Dijk, K., Rosendaal, F., & Mutsert, R. (2020). The prevalence of metabolic syndrome and its association with body fat distribution in middle-aged individuals from indonesia and the netherlands: a cross-sectional analysis of two population-based studies. *Diabetology & Metabolic Syndrome*, 12(1). https://doi.org/10.1186/s13098-019-0503-1

Sholekhah, F., Putri, A., Rahmaddeni, R., & Efrizoni, L. (2024). Perbandingan algoritma naïve bayes dan k-nearest neighbors untuk klasifikasi metabolik sindrom. *Malcom Indonesian Journal of Machine Learning and Computer Science*, 4(2), 507-514. https://doi.org/10.57152/malcom.v4i2.1249

Sofyanita, E. and Wikandari, R. (2023). Deteksi mandiri sindrom metabolik pada masyarakat sebagai pencegahan penyakit tidak menular. *Abdimasku Jurnal Pengabdian Masyarakat*, 6(3), 729. https://doi.org/10.62411/ja.v6i3.1541

Suhaema, S. and Masthalina, H. (2015). Pola konsumsi dengan terjadinya sindrom metabolik. *Kesmas National Public Health Journal*, 9(4), 340. https://doi.org/10.21109/kesmas.v9i4.741

Sufiyanto, S., Yuniarti, S., & Andrijono, R. (2021). Edukasi promosi kesehatan dan pemberdayaan masyarakat pada masa pandemi covid-19. *Prosiding Seminar Nasional Pengabdian Masyarakat Universitas Ma Chung*, 1, 01-14. https://doi.org/10.33479

Yulistianingsih, A. and Firdaus, A. (2023). Hubungan asupan antioksidan dengan kejadian sindrom metabolik remaja obesitas masa adaptasi kebiasaan baru. *Jurnal Ners*, 7(1), 412-419. https://doi.org/10.31004/jn.v7i1.13227

Yusni, Y. and Meutia, F. (2020). Action mechanism of rosella (hibiscus sabdariffa l.) used to treat metabolic syndrome in elderly women. *Evidence-Based Complementary and Alternative Medicine*, 2020(1). https://doi.org/10.1155/2020/5351318