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Community-Based Health Intervention Strategy through Local Product Diversification for Diabetes Mellitus

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ABSTRACT

Introduction: *Diabetes mellitus (DM) remains a major global health challenge, with prevalence increasing both worldwide and in Indonesia, including Kendari City, Southeast Sulawesi. Preventive strategies that integrate community engagement and local food systems are urgently needed.*
Methods: *This study employed a qualitative descriptive design to explore community experiences, perceptions, and involvement in diversifying scad fish into value-added products as a strategy for DM prevention. Research was conducted in Kendari with 32 participants, including health cadres, women's groups, small and medium enterprise (SME) fish processors, and community leaders. Data collection methods consisted of in-depth interviews, focus group discussions, participant observation, and document review. Thematic analysis was applied using Miles and Huberman's framework, supported by triangulation and member checking to ensure credibility.*
Results: *Findings revealed that scad fish, though abundant and affordable, was underutilized due to low preference compared to other fish species. Through participatory processes, communities co-developed scad fish floss and crackers, which were widely accepted for their practicality, longer shelf life, and cultural compatibility. Mothers reported replacing sugary snacks with scad-based products, indicating positive dietary shifts, while SMEs and women's groups gained new livelihood opportunities. Community involvement particularly by health cadres and local leaders was identified as the central factor ensuring acceptance, sustainability, and dissemination of the intervention.*
Conclusions: *The diversification of scad fish into floss and crackers demonstrates a culturally relevant, sustainable, and community-driven approach to DM prevention. Beyond improving nutrition, this intervention also strengthens local economies and promotes social empowerment. The study provides a model for integrating health promotion with local food resources, offering implications for future community-based strategies in resource-rich settings.*

Introduction

Diabetes Mellitus (DM) has become one of the most pressing global health challenges of the 21st century(Kurnia et al., 2025). According to the NCD Risk Factor Collaboration, approximately 828 million adults worldwide were living with diabetes in 2022, with an age-standardized prevalence of 13.9 % for women and 14.3 % for men (Biswas et al., 2022). This upward trend not only places a heavy burden on global healthcare systems but also reduces the

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quality of life for millions of individuals, highlighting the urgent need for preventive strategies that go beyond curative care(Sleeman et al., 2019).

In line with global developments, Indonesia has also experienced a significant increase in diabetes prevalence. National surveys indicate that the prevalence rose from 10.7 % in 2013 to 11.3 % in 2023, with the highest figure of 11.8 % recorded in 2018 (Kurnia et al., 2025)(Indrahadi et al., 2021)(Wahidin et al., 2024). Furthermore, the hidden burden is substantial, as studies estimate that 4.1 % of adults in Indonesia may be living with undiagnosed type 2 diabetes (Nugrahani et al., 2025)(Kurnia et al., 2025)(Muharram et al., 2025). This situation reflects the dual challenge faced by the country a steadily rising prevalence alongside a large proportion of undiagnosed cases, both of which complicate disease management and prevention.

Diabetes Mellitus (DM) has emerged as one of the most pressing global and national public health challenges, with its prevalence steadily increasing across both urban and rural populations(Verma et al., 2021). Conventional clinical approaches, which predominantly emphasize pharmacological treatment and hospital-based education, often fail to address the complex interplay of socio-behavioral and economic determinants that shape individuals' dietary choices and lifestyle habits(Kokil et al., 2015). This gap highlights the need for innovative, community-centered strategies that complement biomedical interventions while fostering long-term behavioral change. In response, community-based health interventions have gained prominence for their ability to integrate participatory engagement, empowerment, and sustainability into local health systems. The present study introduces a novel community-based intervention through local product diversification—specifically, the transformation of locally abundant scad fish (*Decapterus spp.*) into value-added food products—as a culturally grounded and economically viable strategy for diabetes prevention and control. This approach provides distinct added value compared to conventional diabetes intervention programs, as it embeds health education within local food innovation, encourages healthier consumption patterns, and strengthens community ownership of health initiatives.

The situation is equally concerning at the regional level. In Southeast Sulawesi Province, diabetes has become the fifth most burdensome non-communicable disease, with 13,946 documented cases. Within Kendari City, the provincial capital, local health records show an alarming increase, with one community health center reporting a rise from 266 cases in 2022 to 360 cases in 2023, while citywide prevalence is estimated at nearly 0.95 % (Said et al., 2025). The situation is particularly concerning in Southeast Sulawesi, where recent local health surveillance data indicate a consistent rise in diabetes incidence, especially among middle-aged adults in urban and peri-urban coastal communities. Early interventions implemented through primary health centers (*Puskesmas*) such as health counseling, dietary education, and routine screening have been limited in scope and sustainability due to low community participation and the absence of culturally relevant dietary alternatives(Krisnadewi et al., 2024). Consequently, although national and regional health authorities have introduced the Healthy Indonesia Program and the non-communicable disease (*NCD*) control framework emphasizing community empowerment, their impact has yet to be fully realized at the grassroots level. Understanding this chronological evolution from national prevalence growth to the persistent local health gaps in Southeast Sulawesi underscores the urgency of developing innovative, community-driven approaches such as local product diversification to promote healthier eating habits and sustainable diabetes prevention.

Building on this recognition, scholars have increasingly emphasized the importance of community-based health promotion strategies. Unlike standardized, top-down approaches,

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interventions that actively involve communities and integrate cultural practices tend to achieve higher acceptance and sustainability. Evidence also suggests that utilizing local food resources within preventive health programs can improve adherence and reduce reliance on nutritionally poor, processed foods. However, despite Kendari's abundance of marine resources, particularly scad fish (*Decapterus spp.*), these have yet to be strategically employed as part of diabetes prevention efforts. This underutilization highlights a clear gap in both research and practice regarding the role of local food systems in addressing non-communicable diseases.

To address this gap, the diversification of scad fish into value-added products such as floss (*abon*) and crackers (*kerupuk*) presents a promising opportunity. These products are widely acceptable, easy to integrate into daily diets, and possess longer shelf lives, making them practical alternatives to high-sugar snacks commonly consumed in urban settings. More importantly, they provide dual benefits: contributing to healthier dietary patterns while simultaneously generating income opportunities for coastal households, particularly women. This dual impact demonstrates how public health interventions can be designed to align with broader goals of community empowerment and local economic development.

In response to the persistent rise of Diabetes Mellitus (DM) cases in coastal communities of Southeast Sulawesi and the limited sustainability of existing interventions, this study seeks to develop an alternative community-based health promotion approach that leverages locally available marine resources. Specifically, the intervention focuses on the diversification of scad fish–based products (*ikan layang*), a high-protein and omega-3–rich commodity abundant in the Kendari coastal area. This research aims to achieve three main objectives: **(1)** to explore community participation, perception, and readiness in developing scad fish–based products as part of diabetes prevention efforts; **(2)** to design and implement a participatory intervention model that integrates local economic activities with health education and behavioral change strategies; and **(3)** to evaluate the outcomes of this intervention in improving awareness, dietary behavior, and community empowerment toward sustainable NCD prevention. Through these objectives, the study is expected to demonstrate how integrating local food systems into health promotion programs can enhance both community well-being and the sustainability of local economic resources, aligning with Indonesia's national agenda for non-communicable disease control.

Methods

Research Design

This study employed a qualitative descriptive design to explore community experiences, perceptions, and involvement in diversifying local products specifically scad fish floss and crackers as a strategy for diabetes mellitus (DM) prevention. A Mix Method approach was selected to capture in-depth insights into the socio-cultural dynamics of coastal communities and to generate context-specific strategies for sustainable health interventions.

Study Setting and Participants

The research was conducted in Kendari City, Southeast Sulawesi, a region characterized by abundant marine capture fisheries, particularly scad fish (Decapterus spp.). The location was purposively selected due to its strong socio-economic reliance on fish processing activities. The population in this study consisted of all members of coastal community groups engaged in small-scale fish processing and community health empowerment programs in Kendari City, Southeast Sulawesi. Based on records from the local health office and SME registry, approximately 50 community members were identified as the target population for the intervention.

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From this population, 32 participants were selected using purposive sampling to ensure representation of key community stakeholders. The participants included community health cadres, women's group members, SME processors, and local leaders actively involved in promoting household-based fish product diversification and health education.
Inclusion criteria covered: (1) adults aged 18 years or older; (2) residing in the community for at least two years; (3) actively participating in the local program; and (4) willing to take part in the full intervention cycle. Data saturation was achieved within this sample size, confirming its adequacy for a qualitative, community-based study.

Data Collection Techniques and Instruments

Multiple qualitative data collection methods were employed to strengthen the validity of findings. In-depth interviews were used to explore participants' experiences, perceptions, and food consumption practices. Focus group discussions (FGDs) facilitated the co-development of strategies for scad fish–based product diversification, ensuring collective participation and community ownership. Participant observation was carried out to gain direct insights into the production process of scad fish–based products, including the practical challenges faced by local producers. Document review, consisting of local health records and reports on DM prevalence, was conducted to supplement primary data with secondary evidence. Data collection was guided by semi-structured interview and FGD protocols developed by the research team, which allowed flexibility while maintaining focus on core research objectives.

Data Analysis

Data were analyzed thematically following Miles and Huberman's (1994) interactive model, which includes three key stages: data reduction, data display, and conclusion drawing/verification. All interview and focus group discussion (FGD) transcripts were first transcribed verbatim and subsequently coded using NVivo 14 qualitative analysis software to facilitate systematic organization and retrieval of data. Coding began with open coding to identify initial categories, followed by axial coding to link interrelated concepts, and finally selective coding to derive overarching themes related to community participation, behavioral change, and product innovation.

Descriptive summaries of pre–post community responses and dietary patterns were compiled and analyzed using SPSS 26, focusing on frequency distributions and percentage changes to visualize trends in knowledge and behavior before and after the intervention. This limited descriptive quantification complemented the thematic interpretation, providing a clearer representation of community-level changes without altering the qualitative orientation of the study. To ensure credibility and trustworthiness, several strategies were applied:

(1) Data triangulation, involving multiple sources (health cadres, women's groups, SMEs, and community leaders) and methods (interviews, FGDs, observations, and document reviews);
(2) Member checking, conducted by presenting preliminary findings to selected participants for validation of interpretations;
(3) Peer debriefing, carried out within the research team to minimize bias and maintain analytical consistency; and
(4) Audit trail, maintained through NVivo's coding logs and SPSS descriptive output to enhance transparency and replicability.

These combined analytical and validation strategies ensured that findings reflect participants' authentic experiences while maintaining methodological rigor and reliability consistent with qualitative research standards

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Ethical Considerations

The study adhered to ethical principles of research involving human participants. Written informed consent was obtained prior to participation, and confidentiality was ensured by anonymizing all responses. Formal permissions were secured from relevant community and institutional authorities before data collection commenced.

Results

Participant Characteristics

A total of 32 participants were involved in this study, representing diverse community groups relevant to local food diversification and health promotion. These included community health cadres, women's groups, small and medium enterprise (SME) fish processors, and community leaders. This diversity ensured that perspectives from production, consumption, and health promotion were comprehensively captured.

Table 1. Characteristics of Participants

Category	Number (n)	Percentage (%)	Description / Role in Study
Community health cadres	8	25.0	Actively involved in health promotion and nutrition education.
Women's groups	10	31.3	Mothers and women responsible for food preparation and household nutrition.
SME fish processors	9	28.1	Small-scale producers engaged in scad fish processing.
Community leaders	5	15.6	Provided perspectives on community acceptance and cultural practices.
Total	32	100	—

Data Analysis Process

Thematic analysis was conducted systematically following Miles and Huberman's framework. Figure 1 illustrates the step-by-step flow of analysis, from data collection to the generation of final themes.

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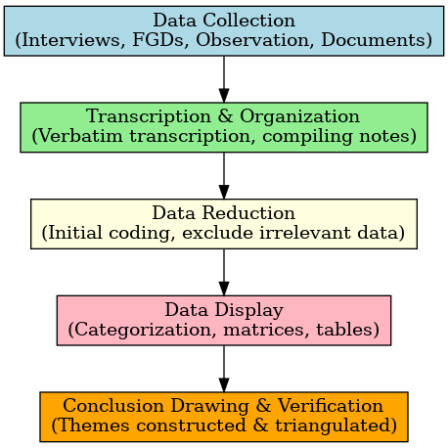

Figure 1. Flowchart of Thematic Analysis Process

Community Perceptions and Resource Potential

Participants reported that scad fish is abundant yet underutilized in Kendari. While affordable and accessible, it was perceived as less desirable compared to more popular fish species such as tuna or milkfish. This perception revealed an opportunity to enhance its value through diversification into more acceptable products.

Table 2. Theme: Community Perceptions of Scad Fish

Theme	Description	Representative Quotes
Abundance and affordability	Scad fish is cheap and widely available in Kendari markets.	"We can easily find scad fish every day, but many people still prefer other fish." (SME processor)
Low preference compared to other species	Scad fish is less popular despite availability.	"It is often left unsold because families think it is less tasty than tuna or milkfish." (Community leader)

Development of Floss and Crackers

FGDs and participatory sessions facilitated the development of two main products: scad fish floss and scad fish crackers. These products were chosen for their practicality, extended shelf life, and broad acceptability. Floss was valued as a convenient protein source, while crackers emerged as a healthier snack alternative, particularly appealing to children.

Figure 2. Co-development Process of Scad Fish–Based Products

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Community Acceptance and Behavioral Shifts

Findings revealed strong acceptance of scad fish products. Mothers reported replacing sugary, low-nutrition snacks with scad fish crackers, while health cadres observed increased awareness of balanced nutrition. Participants linked consumption of these products with healthier daily food practices.

Table 3. Theme: Acceptance and Behavioral Changes

Theme	Description	Representative Quotes
Positive reception	Scad products were accepted across age groups.	"Children like the crackers because they taste good and crunchy." (Mother, FGD)
Healthier eating habits	Substitution of sugary snacks with scad fish products.	"I give them crackers instead of sweets after school." (Mother, interview)

Community Involvement as a Key Success Factor

Community involvement emerged as central to the success of the intervention. Women's groups promoted scad fish products during community events, health cadres integrated them into nutrition education, and community leaders advocated for broader acceptance. This participatory approach strengthened ownership, enhanced trust, and improved sustainability of the program.

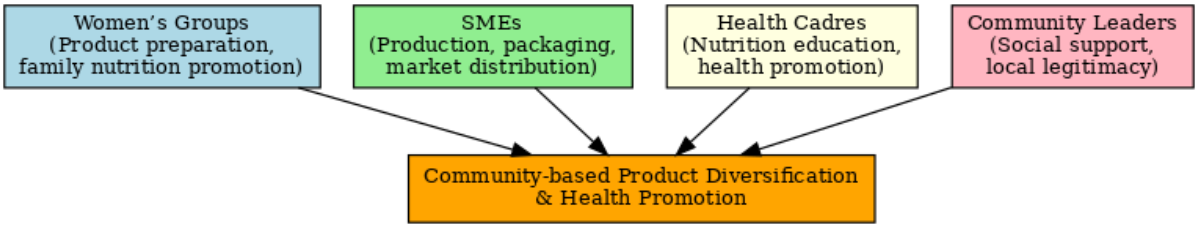

Figure 3. Roles of Community Actors in Supporting Product Diversification

Discussion

The results of this study demonstrate the untapped potential of scad fish as a local marine resource that can be repositioned for both health and economic purposes. While previous studies have highlighted the importance of local food systems in addressing nutrition-related diseases, few have documented concrete cases where undervalued marine species are transformed into culturally acceptable products (Burgaz et al., 2023)(Alarcon et al., 2021) . This research therefore extends the literature on food system innovation by showing how scad fish, once seen as less desirable, can become central to a community-based diabetes prevention strategy.

The intervention highlights the theoretical significance of community-based health promotion models. The strong involvement of women's groups, SMEs, and health cadres illustrates the essence of participatory approaches in public health, where interventions are not externally imposed but internally co-created. This aligns with theories of community empowerment, which suggest that meaningful engagement fosters ownership, contextual relevance, and sustainability(Dushkova & Ivlieva, 2024; Kruahong et al., 2023). The process of co-developing scad fish floss and crackers exemplifies how participatory design enhances intervention fit within existing dietary practices.

From a health promotion perspective, the study underscores the role of culturally relevant innovations in shifting dietary patterns. Mothers' substitution of sugary snacks with

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scad-based crackers reflects not only a change in preference but also an increased awareness of nutrition. This finding resonates with WHO recommendations that emphasize community-level dietary interventions as effective strategies to address non-communicable diseases(KOLAWOLE et al., 2023; Rajashekhar et al., 2025; Shawar, 2025). By focusing on practical, low-cost, and locally accessible alternatives, the intervention reduced barriers to adopting healthier eating behaviors in coastal households.

The participatory and socio-cultural adaptability of this approach also strengthens its position within implementation science. Health cadres acted as trusted intermediaries, bridging formal health services with daily community practices. Their role in disseminating information, conducting taste tests, and promoting the products underscores the importance of local change agents in ensuring adoption and diffusion. Consistent with Rogers' Diffusion of Innovations theory(Wolf, 2022), compatibility with existing dietary norms and perceived relative advantage facilitated the acceptance of scad fish products.

Another implication is the integration of economic sustainability into health promotion. The co-development process created new livelihood opportunities for SMEs and women entrepreneurs, particularly through product production and distribution. This dual focus illustrates the applicability of the Triple Bottom Line framework integrating health, social, and economic dimensions into a single intervention. By doing so, the study bridges a gap in existing research that often treats health and livelihood interventions separately, demonstrating that synergistic benefits can be achieved when they are combined.

Comparative insights with recent studies strengthen these findings. For example (Gibson et al., 2024; Ziso et al., 2022) emphasized that local food environments are directly linked to diabetes prevalence, highlighting the urgency of healthier alternatives in daily diets. Our study builds on this by showing that health outcomes can be improved not only through restricting unhealthy food outlets but also by positively transforming undervalued local resources into acceptable products. Similarly, confirmed(Budiasa, 2025; Lopes et al., 2024) the effectiveness of community-based NCD interventions, and our work contributes a novel marine-based case study to that growing body of evidence.

Despite these contributions, several challenges remain. Household-scale production is limited in capacity, raising concerns about continuity of supply and the ability to meet growing demand. Issues of food safety, labeling, and standardization must also be addressed before the products can expand to wider markets. Furthermore, marketing and branding strategies will be crucial to scale the initiative beyond Kendari. These challenges point to the need for capacity building and stronger institutional support to ensure long-term sustainability.

Finally, the study's limitations must be acknowledged. The qualitative design, while providing depth and contextual richness, limits the generalizability of findings to other settings. The absence of quantitative health measures, such as changes in blood glucose levels or dietary intake frequency, restricts the ability to confirm direct health outcomes. The relatively short observation period also makes it difficult to assess whether behavior changes are maintained over time. Future research should therefore incorporate mixed-methods approaches, longitudinal assessments, and multi-site replication to validate and extend the findings of this study.

Conclusion

This study demonstrates that the community-led diversification of scad fish into floss and crackers offers a feasible and sustainable strategy for Type 2 diabetes prevention in coastal communities by combining nutritional benefits with economic empowerment. The intervention, co-developed and promoted by women's groups, SMEs, health cadres, and community leaders, proved both culturally relevant and socially accepted, illustrating the strength of participatory

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health promotion. Beyond improving dietary practices, the initiative aligns with the Triple Bottom Line framework by simultaneously addressing health, social, and economic dimensions. While limitations such as qualitative scope and the absence of quantitative health outcomes restrict generalizability, the findings provide a foundation for future mixed-methods research and policy interventions. With appropriate institutional support, this model holds potential for replication in other resource-based communities facing similar challenges of non-communicable disease prevention and livelihood insecurity

Ethics approval and consent to participate

Ethical review and approval were waived for this study by the Health Research Ethics Committee of Universitas Mandala Waluya because the research involved non-invasive qualitative methods, such as interviews, focus group discussions, and observations, without collecting identifiable health or clinical data. Nevertheless, written informed consent was obtained from all participants. Participants were assured of confidentiality, anonymity, and their voluntary right to participate or withdraw at any stage.

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