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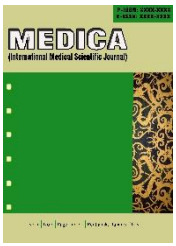

Path Analysis of Food Literacy and eHealth Literacy on Diet Quality through Nutritional Self-Efficacy among Pregnant Women in Urban Indonesia: A Cross-Sectional Study

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Abstract

Maternal diet quality during pregnancy remains critically suboptimal in Indonesia, contributing to the high prevalence of anemia and adverse pregnancy outcomes. This study aimed to analyze the direct and indirect effects of food literacy and eHealth literacy on diet quality through nutritional self-efficacy among pregnant women in urban Indonesia. A cross-sectional analytical study was conducted on 238 pregnant women in the second and third trimesters at Puskesmas Wara Selatan, Palopo City, South Sulawesi. Data were collected using four validated instruments: the Self-Perceived Food Literacy Scale, the eHealth Literacy Scale (comprising the core eHEALS items and a digital information access sub-dimension), the Nutrition Self-Efficacy Scale, and the Minimum Dietary Diversity for Women indicator via 24-hour dietary recall. Partial Least Squares Structural Equation Modeling with 5,000 bootstrap resamples was employed. Results showed that food literacy had the strongest direct effect on diet quality ($\beta=0.689$; $p<0.001$) and significantly predicted nutritional self-efficacy ($\beta=0.453$; $p<0.001$). eHealth literacy significantly influenced nutritional self-efficacy ($\beta=0.484$; $p<0.001$) but did not directly affect diet quality ($\beta=0.162$; $p=0.254$). Nutritional self-efficacy significantly predicted diet quality ($\beta=0.140$; $p=0.036$) and served as a partial mediator in the food literacy–diet quality pathway and a full mediator in the eHealth literacy–diet quality pathway. The model explained 48.5% of diet quality variance and 77.8% of nutritional self-efficacy variance. These findings confirm that nutritional self-efficacy constitutes a critical intervention point for optimizing maternal diet quality in urban primary healthcare settings.

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1. INTRODUCTION

Maternal diet quality during pregnancy is a fundamental determinant of fetal growth, placental function, and long-term offspring health outcomes. Suboptimal nutritional intake during gestation not only increases the risk of acute maternal complications but also contributes to intergenerational cycles of malnutrition through epigenetic programming mechanisms. Data from the 2022 Indonesian Nutrition Status Survey (SSGI) confirmed that anemia prevalence among pregnant women remained elevated at 28.1% nationally, with South Sulawesi Province recording a prevalence of 30.2%, consistently linked to low dietary diversity and micronutrient inadequacy (Kementerian Kesehatan Republik Indonesia, 2023). The Food and Agriculture Organization recommends Minimum Dietary Diversity for Women (MDD-W) as a validated proxy indicator for micronutrient adequacy among women of reproductive age, wherein consumption of at least five out of ten food groups is considered reflective of adequate diet quality. Low MDD-W scores among pregnant women have been consistently associated with higher anemia prevalence and adverse pregnancy outcomes across diverse settings (Sharma, et al., 2024).

Food literacy constitutes a comprehensive, multi-dimensional construct that extends well beyond conventional nutritional knowledge, encompassing practical skills necessary for navigating complex food environments. It is operationally defined as an interconnected set of knowledge, skills, and behaviors including the capacity to plan, manage, select, prepare, store, and consume food enabling individuals to fulfill their nutritional needs autonomously. The Self-Perceived Food Literacy (SPFL) Scale operationalizes this construct across eight measurable behavioral domains and has been validated in association with diet quality in adult populations. A systematic scoping review confirmed that food literacy-based intervention programs consistently produced dietary intake improvements, with the largest effects observed in studies explicitly integrating a food literacy framework (O'Brien, MacDonald-Wicks, & Heaney, 2024). Crucially, the SPFL instrument has not been applied to pregnant women a population with distinct and heightened nutritional requirements representing a substantive gap in the maternal nutrition literature (Sherer, 2025).

Concurrent with accelerating digital penetration across Indonesia, eHealth literacy has emerged as an increasingly relevant determinant of health-related behaviors. Defined as the individual's capacity to seek, find, understand, evaluate, and apply health information from electronic sources, eHealth literacy is particularly pertinent given that Indonesia's internet penetration exceeded 78% in 2023, rendering digital platforms the primary channel through which pregnant women access nutritional information. Studies conducted among pregnant populations demonstrate that eHealth literacy significantly predicts structured dietary behaviors and adherence to health-promoting practices (Li et al., 2024). In this study, the eHealth literacy construct was operationalized into two complementary dimensions: the core eHEALS items measuring evaluative capacity for digital health information, and a digital information access sub-dimension measuring the intensity and patterns of digital platform utilization for nutritional information.

Although food literacy and eHealth literacy represent cognitive resources with recognized potential to improve dietary behavior, their translation into actual dietary change is unlikely to occur through direct pathways alone. Social Cognitive Theory posits that self-efficacy an individual's belief in their capacity to execute specific actions functions as a critical mediating mechanism between knowledge acquisition and behavioral enactment. In the context of maternal nutrition, nutritional self-efficacy reflects pregnant women's confidence in their ability to consistently select and consume nutritious food despite contextual barriers including time constraints, food price volatility, and competing

information sources. A mediation study confirmed that dietary self-efficacy bridges the relationship between health literacy and nutrition-related behavioral outcomes (Pan et al., 2025).

No prior study has simultaneously examined the integrated pathways among food literacy, eHealth literacy, nutritional self-efficacy, and diet quality in pregnant women using a structural mediation framework within the Indonesian context. A systematic review identified only five global studies evaluating nutrition literacy in pregnant women, none of which incorporated eHealth literacy or tested the mediating role of self-efficacy (Sherer, 2025). A cross-sectional study among Australian pregnant women documented associations between diet quality, nutrition self-efficacy, and nutrition information sources, yet did not employ a formal mediation analytical framework. These gaps underscore the need for an integrative, theoretically grounded investigation capable of elucidating the mechanistic pathways through which literacy constructs translate into dietary behavior among pregnant women in urban, lower-middle-income settings.

Palopo City, as a developing urban center in South Sulawesi experiencing concurrent urbanization, expanding digital infrastructure, and persistent maternal nutrition challenges, provides an ecologically valid and contextually relevant setting for this investigation. The Puskesmas Wara Selatan service area encompasses sub-districts with heterogeneous socioeconomic profiles characteristic of secondary Indonesian cities. This study aimed to examine the direct and indirect effects of food literacy and eHealth literacy on diet quality, with nutritional self-efficacy as a mediating variable, among pregnant women attending primary healthcare services in urban Indonesia.

2. METHOD

This study employed a cross-sectional analytical design to investigate the pathway effects of food literacy and eHealth literacy on diet quality, mediated by nutritional self-efficacy, among pregnant women in Palopo City. The study was conducted within the service area of Puskesmas Wara Selatan, Palopo City, South Sulawesi Province a site selected for its relevance as a secondary urban context simultaneously experiencing accelerated digital penetration and persistent maternal nutrition challenges. The cross-sectional design, while enabling efficient data collection across a heterogeneous population, does not permit causal inference; the directionality of observed associations should therefore be interpreted with appropriate caution.

The target population comprised all pregnant women in the second and third trimesters registered and actively accessing antenatal care (ANC) services at Puskesmas Wara Selatan. Restriction to the second and third trimesters was based on the clinical rationale that women in these periods have generally surpassed the dominant phase of nausea and vomiting, thereby enabling dietary recall data to more accurately reflect habitual eating behavior. Inclusion criteria comprised: pregnant women in the second or third trimester, aged 18–45 years, permanent residents within the Puskesmas Wara Selatan service area, willing to participate with signed informed consent, and possessing a smartphone with an active internet connection. Exclusion criteria included pregnant women with severe medical complications affecting dietary intake, such as severe hyperemesis gravidarum, gestational diabetes requiring strict therapeutic dietary management, or other conditions necessitating specialized dietary restrictions.

The sampling technique employed was consecutive sampling, wherein all eligible pregnant women attending ANC services during the study period were systematically recruited until the target sample was reached. This approach, while pragmatic in primary healthcare settings, may introduce selection bias by over-representing women with regular

ANC attendance, potentially limiting the generalizability of findings to women with irregular or no facility-based care. The minimum sample size was determined using the inverse square root method recommended for PLS-SEM, with a minimum path coefficient of 0.14, statistical power of 0.80, and a significance level of 0.05, yielding a minimum requirement of 211 respondents. The additional rule-of-thumb from Sarstedt, Ringle, & Hair (2021) a minimum of ten times the largest number of structural paths directed at any single construct required a minimum of 30 respondents. The final achieved sample of 238 respondents exceeded both thresholds, ensuring adequate statistical power for PLS-SEM estimation.

Data collection was conducted from May to September 2025 through face-to-face structured interviews administered by five trained enumerators with midwifery backgrounds. Enumerators completed a two-day standardized training program covering the research protocol, instrument administration procedures, the FAO multiple-pass 24-hour dietary recall methodology, use of standardized visual aids (food photographs and volumetric models), and inter-rater reliability calibration exercises. Each interview was conducted in a private room within the healthcare facility and lasted approximately 30–40 minutes.

Data collection instruments comprised four components. First, food literacy was assessed using the Self-Perceived Food Literacy (SPFL) Scale, consisting of 29 items across eight behavioral domains: planning and managing, selecting, preparing, consuming, storing, reading labels, budgeting for healthy food, and healthy food awareness. Second, eHealth literacy was measured using the eHealth Literacy Scale (eHEALS) developed by Norman and Skinner (2006), comprising eight items on a five-point Likert scale. Within the PLS-SEM framework, the eHealth literacy construct was operationalized into two reflective dimensions: (a) the core eHEALS dimension measuring evaluative capacity for digital health information, and (b) the digital information access dimension, comprising four researcher-developed items measuring the frequency and diversity of digital platform use for nutritional information during pregnancy. These four items were grounded in the digital health information-seeking behavior framework (Jacobs et al., 2017) and assessed for content validity by three experts in digital health and maternal nutrition, yielding a Scale-Content Validity Index (S-CVI) of 0.92. Third, nutritional self-efficacy was assessed using the Nutrition Self-Efficacy Scale Schwarzer & Renner, (2009), comprising five items. Fourth, diet quality was evaluated using the FAO multiple-pass 24-hour dietary recall, classified across ten MDD-W food groups, with the continuous dietary diversity score (0–10) serving as the diet quality outcome measure.

All questionnaire instruments (SPFL, eHEALS, digital information access items, and NSES) underwent forward-backward translation from English into Bahasa Indonesia, involving two independent translators and back-translators with health science expertise. A pilot test was conducted with 30 pregnant women outside the study sample at a neighboring primary health center. Internal consistency was evaluated using Cronbach's Alpha, with all instruments achieving values above 0.70 (SPFL: α=0.94; eHEALS: α=0.89; digital information access: α=0.85; NSES: α=0.82), confirming adequate reliability.

Data analysis employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4. PLS-SEM was selected for its suitability in estimating complex latent variable models without requiring multivariate normality assumptions and its orientation toward prediction in structural models that are not yet fully theoretically established. Evaluation proceeded in two stages: (1) the measurement model (outer model), encompassing convergent validity (outer loadings ≥ 0.60; AVE ≥ 0.50), discriminant validity (Fornell-Lacker criterion and Heterotrait-Monotrait ratio [HTMT]), and

reliability (Composite Reliability and Cronbach's Alpha ≥ 0.70); and (2) the structural model (inner model), encompassing collinearity assessment (VIF < 5.0), R^2, effect sizes (f^2), and path coefficient significance via 5,000-resample bootstrapping. The outer loading threshold of ≥ 0.60 was adopted in line with Sarstedt, Ringle, & Hair (2021), who permit this threshold in exploratory research contexts provided that AVE values meet the ≥ 0.50 criterion. Mediation effects were evaluated using 95% bias-corrected bootstrapped confidence intervals; mediation was considered significant when the confidence interval excluded zero (Sarstedt, Ringle, & Hair, 2021). It is acknowledged that the cross-sectional design does not permit causal conclusions, and that the use of consecutive sampling in a single primary healthcare facility limits the external validity of findings; these constraints should be considered when interpreting the results of the mediation analyses. Statistical significance was set at $\alpha = 0.05$. Ethical approval was obtained from the Health Research Ethics Committee of Politeknik TEDC Bandung (Protocol: 102PKE-240425, Date: 24 April 2025). All procedures adhered to the principles of the Declaration of Helsinki. Informed consent was obtained from all participants prior to data collection. Ethical approval was obtained from the Health Research Ethics Committee of Politeknik TEDC Bandung (Protocol: 102PKE-240425; Date: 24 April 2025). All procedures were conducted in accordance with the principles of the Declaration of Helsinki, and informed consent was obtained from all participants prior to data collection.

3. RESULTS AND DISCUSSION

A total of 238 pregnant women in the second and third trimesters participated in this study from the Puskesmas Wara Selatan service area, Palopo City. The sociodemographic characteristics of respondents are presented in Table 1.

Table 1. Respondent Characteristics (n=238).

Characteristic	Category	n	%
Education Level	Elementary school or equivalent	14	5.9
	Junior high school or equivalent	28	11.8
	Senior high school or equivalent	132	55.5
	Diploma (D1/D2/D3)	33	13.9
	Bachelor's degree (S1) or higher	31	13.0
Occupation	Housewife	194	81.5
	Civil servant	18	7.6
	Private employee	20	8.4
	Self-employed	6	2.5
Monthly Income	< IDR 1,500,000	19	8.0
	IDR 1,500,000–3,000,000	43	18.1
	IDR 3,000,001–5,000,000	67	28.2
	IDR 5,000,001–7,500,000	81	34.0
	> IDR 7,500,000	28	11.8
Parity	Primipara	78	32.8
	Multipara	160	67.2
Gestational Age	Second trimester	134	56.3
	Third trimester	104	43.7
ANC Visits	1 visit	18	7.6
	2 visits	43	18.1
	3 visits	89	37.4
	>3 visits	88	37.0

Table 1 shows that the majority of respondents had senior high school education (55.5%), were housewives (81.5%), and were multiparous (67.2%). All respondents possessed smartphones with active internet connections as per the inclusion criteria, rendering eHealth literacy a contextually meaningful construct for this population. This sociodemographic profile is consistent with urban primary healthcare populations in secondary Indonesian cities, where digital access is increasingly prevalent yet maternal nutrition challenges persist (Fatimah et al., 2025).

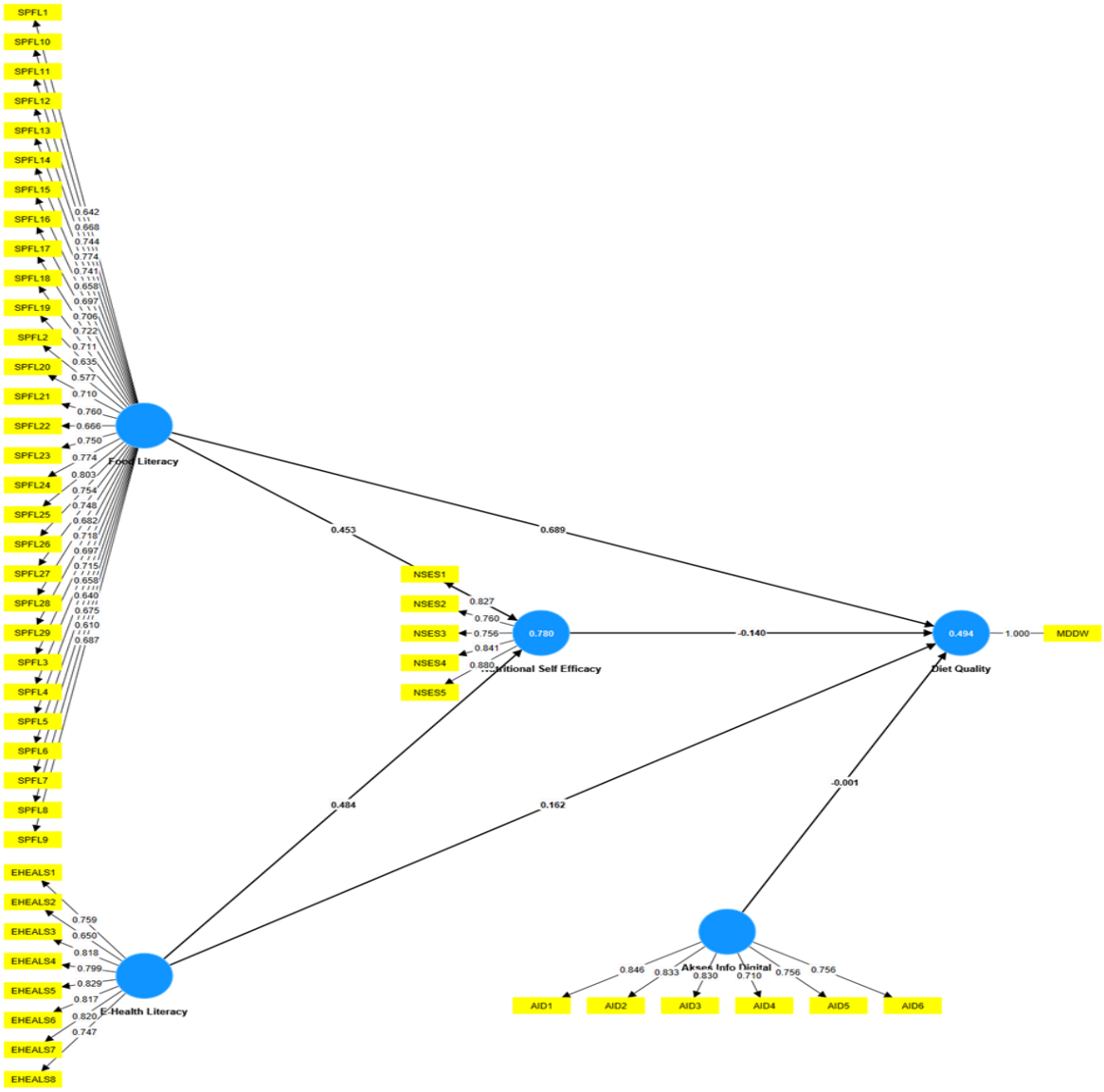

Figure 1. Measurement Model Evaluation (Outer Model).

Figure 1 shows that the results of the measurement model evaluation are presented below. Nearly all indicators achieved outer loading values above 0.60, with the single exception of SPFL2 (loading = 0.577), which was retained on the basis that the AVE for the Food Literacy construct (0.549) continued to exceed the minimum threshold of 0.50, such that item removal would not meaningfully improve construct validity (Sarstedt,

Ringle, & Hair, 2021). All AVE values surpassed the 0.50 threshold, confirming convergent validity across all constructs (Table 2).

Table 2. AVE Test Results.

Construct	AVE
Digital Information Access*	0.624
eHealth Literacy (core eHEALS)	0.612
Food Literacy	0.549
Nutritional Self-Efficacy	0.663

**Sub-dimension of the eHealth Literacy construct measuring intensity of digital platform utilization for nutritional information*

Table 3. Reliability Test Results.

Construct	CR (rho_a)	Cronbach's Alpha
Digital Information Access	0.884	0.879
eHealth Literacy	0.913	0.908
Food Literacy	0.965	0.963
Nutritional Self-Efficacy	0.875	0.872

All constructs demonstrated CR and Cronbach's Alpha values above 0.70, confirming satisfactory reliability. The highest internal consistency was observed for the Food Literacy construct (CR = 0.965; α = 0.963), consistent with established psychometric properties of the SPFL Scale in adult samples (Trieste & Bazzani, 2021).

Discriminant validity was assessed using two complementary criteria. First, the Fornell-Lacker Criterion confirmed that the square root of each construct's AVE exceeded its highest inter-construct correlation: Digital Information Access (√AVE = 0.879), eHealth Literacy (√AVE = 0.878), Food Literacy (√AVE = 0.870), and Nutritional Self-Efficacy (√AVE = 0.881). The highest inter-construct correlation was observed between Food Literacy and Digital Information Access (r = 0.856), which remained below the respective √AVE values, thus satisfying this criterion for all construct pairs. Second, Heterotrait-Monotrait (HTMT) ratios were examined following Henseler et al. (2015), applying the conservative threshold of 0.85 for conceptually distinct constructs and the liberal threshold of 0.90 for conceptually proximal constructs. HTMT values between Diet Quality and all other constructs ranged from 0.598 to 0.695, well below both thresholds. However, several construct pairs among the literacy and self-efficacy variables yielded HTMT values between 0.824 and 0.936, exceeding the conservative 0.85 threshold. This finding warrants critical attention: the elevated HTMT ratios suggest non-trivial conceptual overlap among food literacy, eHealth literacy, digital information access, and nutritional self-efficacy constructs, all of which draw from overlapping theoretical domains within health literacy and Social Cognitive Theory. While the Fornell-Lacker criterion was satisfied for all pairs, the HTMT exceedances indicate that the current operationalization of these constructs may not achieve full discriminant separation. Future studies should consider item refinement or construct reconceptualization to address this measurement limitation (Hair et al., 2021; Henseler et al., 2015).

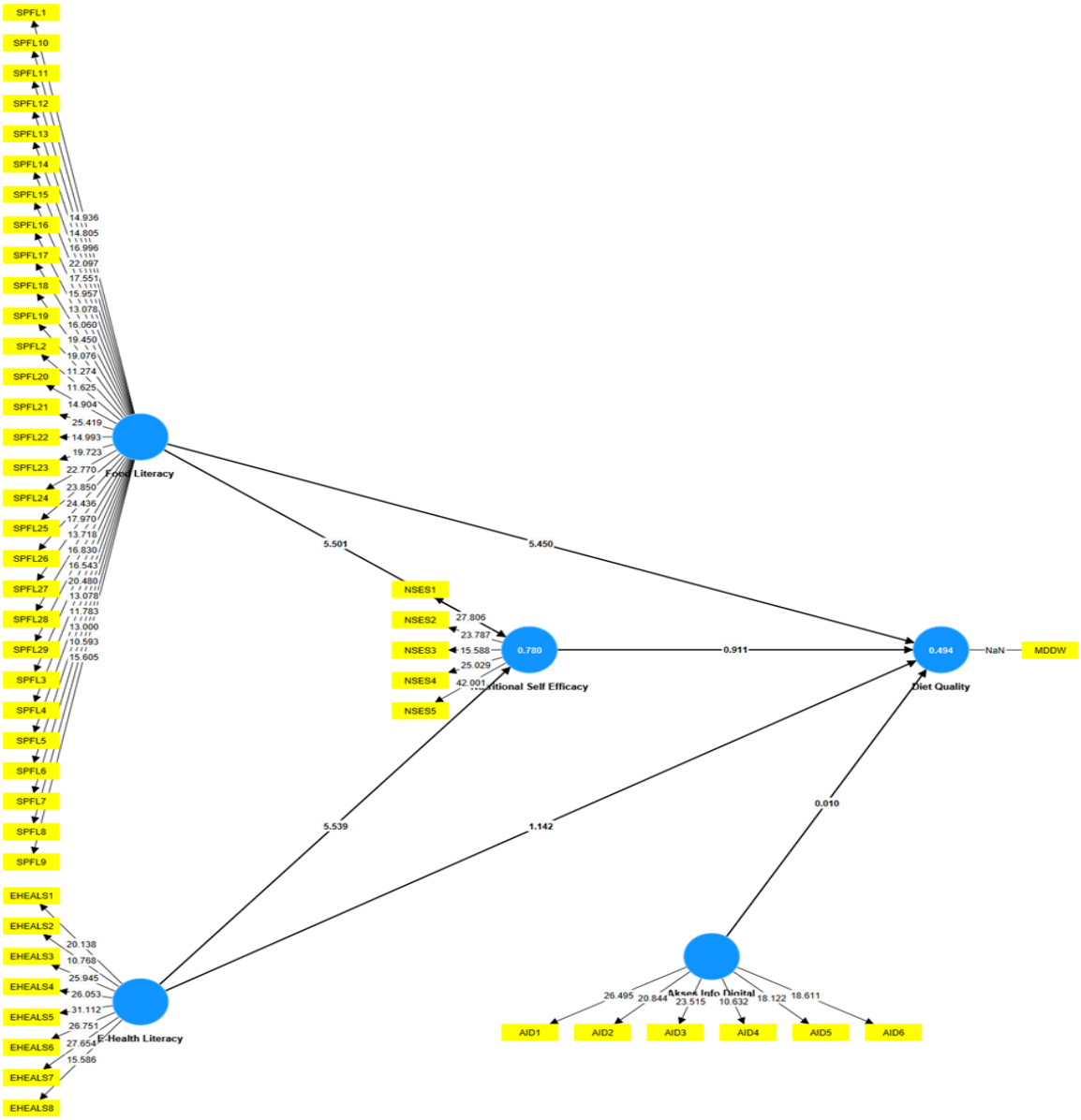

Figure 2. Structural Model Evaluation (Inner Model).

The structural model results are summarized below. The R^2 for Diet Quality was 0.494 (adjusted R^2 = 0.485), indicating that 48.5% of its variability was explained by the predictor variables in the model. The R^2 for Nutritional Self-Efficacy was 0.780 (adjusted R^2 = 0.778), indicating that 77.8% of its variance was explained by Food Literacy and eHealth Literacy. These R^2 values reflect a model with strong explanatory power for Nutritional Self-Efficacy and moderate-to-substantial explanatory power for Diet Quality, consistent with the complexity of dietary behavior determination in pregnant populations (Phillips et al., 2025).

Collinearity assessment confirmed that all inner VIF values were below the critical threshold of 5.0 (range: 2.524–4.753), ruling out severe multicollinearity. Nonetheless, four of the six paths recorded VIF values above 3.5 specifically, Digital Information Access → Diet Quality (4.679), Food Literacy → Diet Quality (4.641), Nutritional Self-Efficacy → Diet

Quality (4.753), and eHealth Literacy → Diet Quality (3.840) indicating moderate collinearity among predictors of diet quality. This pattern is consistent with the high inter-construct correlations and elevated HTMT ratios observed in the measurement model, and necessitates cautious interpretation of individual path coefficients directed at diet quality. Effect size and hypothesis testing results are presented in Tables 4, 5, and 6.

Table 4. f² (Effect Size) Test Results.

Path	f²	Category
Digital Info Access → Diet Quality	0.001	Small
eHealth Literacy → Diet Quality	0.014	Small
eHealth Literacy → Nutritional Self-Efficacy	0.422	Large
Food Literacy → Diet Quality	0.202	Medium
Food Literacy → Nutritional Self-Efficacy	0.370	Large
Nutritional Self-Efficacy → Diet Quality	0.008	Small

Table 5. Direct Effect Hypothesis Testing Results.

Path	β	T-statistic	p-value	Decision
Food Literacy → NSE (H1)	0.453	5.501	<0.001	Supported
eHealth Literacy → NSE (H2)	0.484	5.539	<0.001	Supported
Food Literacy → Diet Quality (H3)	0.689	5.450	<0.001	Supported
eHealth Literacy → Diet Quality (H4)	0.162	1.142	0.254	Not Supported
NSE → Diet Quality (H5)	0.140	2.911	0.036	Supported

Table 6. Indirect Effect Hypothesis Testing Results

Mediation Path	β	T-statistic	p-value	Decision
FL → NSE → DQ (H6)	0.064	2.893	0.037	Supported
EHL → NSE → DQ (H7)	0.068	2.870	0.038	Supported

Note: *NSE = Nutritional Self-Efficacy; FL = Food Literacy; EHL = eHealth Literacy; DQ = Diet Quality; bootstrapping 5.000 resamples.*

DISCUSSION

Food Literacy, Nutritional Self-Efficacy, and Diet Quality

Food literacy demonstrated a positive and significant direct effect on both nutritional self-efficacy (β = 0.453; p < 0.001; f² = 0.370, large) and diet quality (β = 0.689; p < 0.001; f² = 0.202, medium), providing support for H1 and H3. The food literacy–diet quality pathway represented the strongest direct effect in the entire structural model, confirming food literacy as the dominant predictor of maternal dietary adequacy as measured by MDD-W scores. In the Palopo City urban context, where households simultaneously navigate traditional food practices and modern food market pressures, high food literacy likely confers a practical navigational advantage: women who possess robust planning, selection, and label-reading competencies are better positioned to make nutritionally adequate food choices despite economic constraints and food environment complexity (Fatimah et al., 2025; Ares et al., 2024). This finding aligns with the systematic scoping review by O'Brien, MacDonald-Wicks, & Heaney (2024), which confirmed that food literacy frameworks consistently drive dietary improvement. It is noteworthy that food literacy also exerted a large effect on nutritional self-efficacy (f² = 0.370), suggesting that women with higher functional food competencies develop greater confidence in sustaining nutritious dietary practices, a relationship that is particularly relevant in secondary urban

settings where food literacy education through ANC programs remains underdeveloped (Amoore et al., 2023).

eHealth Literacy, Nutritional Self-Efficacy, and Diet Quality

eHealth literacy exerted a significant and large effect on nutritional self-efficacy ($\beta = 0.484$; $p < 0.001$; $f^2 = 0.422$) but did not produce a significant direct effect on diet quality ($\beta = 0.162$; $p = 0.254$; $f^2 = 0.014$, small), supporting H2 while not supporting H4. This pattern is theoretically meaningful: the capacity to access and critically evaluate digital nutritional information does not independently translate into dietary behavior change unless it is mediated through a psychological mechanism such as self-efficacy. In the urban Indonesian context, where pregnant women are exposed to abundant but often inconsistent digital health information from social media platforms, health applications, and online consultation services possessing eHealth literacy alone may not be sufficient to overcome motivational and volitional barriers to dietary improvement (Keles et al., 2024; Li et al., 2024). A structural equation modeling study in adult women confirmed that self-efficacy mediates the association between cognitive capacity and realized dietary behavior (Aynehchi et al., 2023). The non-significant direct eHealth literacy–diet quality path, combined with its large effect on self-efficacy, indicates that eHealth literacy operates as a capacity-building resource whose dietary impact is fully contingent on the individual's motivational confidence a finding with important implications for digital nutrition intervention design (Jiao et al., 2022).

Nutritional Self-Efficacy and Diet Quality

Nutritional self-efficacy had a positive and statistically significant direct effect on diet quality ($\beta = 0.140$; $p = 0.036$; $f^2 = 0.008$), supporting H5. However, this result requires critical contextual interpretation: while the pathway achieves statistical significance, the f^2 value of 0.008 classifies the effect as very small according to Cohen's convention. This small practical effect size is not anomalous but reflects the competitive model context in which food literacy ($f^2 = 0.202$, medium) dominates diet quality prediction, effectively attenuating the independent variance attributable to self-efficacy alone. (diperbaiki sesuai revisi ke-1) It is plausible that in the Palopo City context, where economic and structural food access barriers are notable, self-efficacy beliefs translate into dietary behavior primarily when supported by sufficient environmental resources; in the absence of such resources, high self-efficacy may not sufficiently overcome structural barriers to dietary diversity (Fatimah et al., 2025; Khairy et al., 2021). This interpretation is consistent with ecological models of health behavior, which emphasize the interaction between psychological determinants and environmental affordances in shaping dietary outcomes (Holley & Haycraft, 2022).

Mediation Effects of Nutritional Self-Efficacy

Nutritional self-efficacy significantly mediated both the food literacy–diet quality pathway ($\beta = 0.064$; $p = 0.037$) as partial mediation, and the eHealth literacy–diet quality pathway ($\beta = 0.068$; $p = 0.038$) as full mediation, supporting H6 and H7. The partial mediation in the food literacy pathway indicates that food literacy influences diet quality through two mechanisms: a direct behavioral competency pathway and an indirect pathway operating through enhanced self-efficacy. The full mediation in the eHealth literacy pathway is particularly consequential for intervention design, as it implies that digital information access alone is insufficient self-efficacy must be cultivated as an intermediate target if eHealth literacy is to produce dietary improvement (Jiao et al., 2022;

Yang et al., 2024). These mediation patterns align with Social Cognitive Theory, which positions self-efficacy as the translational mechanism between cognitive resources and behavioral enactment (Abusubhiah et al., 2023). From a practical standpoint in Palopo City's primary healthcare context, these findings suggest that antenatal nutrition promotion programs should move beyond information delivery toward structured self-efficacy strengthening through goal-setting, behavioral modeling, and mastery experience reinforcement as a core and non-negotiable intervention component (Fatimah et al., 2025).

Several limitations must be acknowledged. The cross-sectional design precludes causal inference, and the directionality of observed associations cannot be definitively established. The use of consecutive sampling at a single puskesmas limits generalizability to other urban or rural Indonesian settings. Diet quality was assessed using a single 24-hour dietary recall, which may not fully capture habitual dietary patterns and is susceptible to recall bias. All predictor constructs were measured via self-report, introducing potential social desirability bias. The digital information access sub-dimension was newly developed for this study; while content validity was established (S-CVI = 0.92), broader psychometric validation across diverse populations remains warranted. Several HTMT ratios exceeded the conservative 0.85 threshold, indicating potential construct overlap that future studies should address through refined operationalization. Moderate collinearity among predictors of diet quality (VIF range: 2.524–4.753) warrants cautious interpretation of individual path coefficients.

4. CONCLUSION

This study demonstrated that food literacy and eHealth literacy operate through distinct pathways to influence maternal diet quality among pregnant women in urban Indonesia, with nutritional self-efficacy serving as a critical mediating mechanism. Food literacy was confirmed as the dominant predictor of diet quality through both a direct competency pathway and a self efficacy mediated indirect pathway, while eHealth literacy influenced diet quality exclusively through full mediation by nutritional self efficacy. These findings carry direct implications for the design of antenatal nutrition programs in urban primary healthcare: interventions should integrate food literacy skill-building and digital health information navigation alongside explicit strategies to strengthen nutritional self-efficacy, rather than relying on information delivery alone. Healthcare professionals, particularly midwives and nutritionists in primary care, are encouraged to incorporate food literacy and eHealth literacy assessment into routine ANC protocols. Community health workers should be equipped with integrated modules supporting pregnant women in critically evaluating digital nutritional information and building dietary self-confidence. Future research should employ multi-site longitudinal designs with objective dietary biomarkers and larger, more diverse samples to confirm the causal directionality and generalizability of the proposed theoretical model.

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