

Identification of Food Expenditure and Food Security of Muslim Households: Evidence from Indonesian Family Life Survey 2007 and 2014

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Abstract. This study examines the impact of religiosity on household food consumption and food security in Indonesia, particularly among Muslim households. Despite the acknowledgment of religious factors in food-related policies, limited research has explored their specific influence on food expenditure and security. Using longitudinal data from the Indonesian Family Life Survey (IFLS) covering 2007 and 2014, this study analyzes food expenditure and food security levels among Muslim households, employing the Propensity Score Matching (PSM) model. The analysis includes variables such as age, education, marital status, employment, and gender. Findings reveal that religiosity negatively influences food expenditure, both in total and per capita, suggesting that religious households tend to spend less on food. Moreover, Muslim households demonstrate higher levels of food security, often reporting moderate or adequate food security, compared to non-religious households. This indicates a potential protective effect of religiosity on food stability. The study recommends integrating financial education programs that emphasize frugality and mindful consumption. Additionally, strengthening community-based support systems, such as zakat and sadaqah, could play a crucial role in improving food assistance and security.

Key words: Food expenditure, food security, Muslim household, propensity score matching (PSM).

Abstrak. Penelitian ini menganalisis pengaruh religiositas terhadap pola konsumsi makanan dan ketahanan pangan rumah tangga di Indonesia, khususnya pada rumah tangga Muslim. Meskipun faktor agama diakui dalam kebijakan terkait pangan, sedikit penelitian yang mengeksplorasi pengaruh spesifiknya terhadap pengeluaran dan ketahanan pangan. Menggunakan data longitudinal dari Indonesian Family Life Survey (IFLS) tahun 2007 dan 2014, penelitian ini menganalisis pengeluaran makanan dan tingkat ketahanan pangan rumah tangga Muslim dengan menggunakan model Propensity Score Matching (PSM). Variabel yang digunakan mencakup faktor sosio-ekonomi seperti usia, pendidikan, status perkawinan, pekerjaan, dan jenis kelamin. Hasil penelitian menunjukkan bahwa religiositas berpengaruh negatif terhadap pengeluaran makanan, baik secara total maupun per kapita, yang menunjukkan bahwa rumah tangga religius cenderung mengeluarkan lebih sedikit uang untuk makanan. Selain itu, rumah tangga Muslim cenderung memiliki ketahanan pangan yang lebih baik, dengan lebih banyak yang berada pada kategori ketahanan pangan moderat atau cukup dibandingkan rumah tangga non-religius. Hal ini menunjukkan adanya pengaruh positif religiositas terhadap stabilitas pangan rumah tangga. Penelitian ini menyarankan perlunya integrasi program pendidikan keuangan yang mengedepankan konsumsi yang bijak dan hemat untuk meningkatkan ketahanan pangan di tingkat rumah tangga, serta memperkuat sistem dukungan berbasis komunitas melalui zakat dan sedekah.

Kata Kunci: Keluarga Muslim, ketahanan pangan, pengeluaran makanan, propensity score matching (PSM).

INTRODUCTION

Individual religiosity and behavior influence food consumption patterns (Suleman et al., 2021). Consumers have preferences in choosing the food they will consume, depending on their social values about how and by whom the food is produced (Rausser et al., 2015). Individual heterogeneity towards beliefs, perceptions, and attitudes toward food significantly affects their willingness to pay to buy and pay for food that is more in line with their idiosyncratic needs and beliefs (Lusk and Briggeman, 2009). Religiosity and religion have a role in the food system through specific guidelines about what is allowed and forbidden to eat and how food should be eaten (Heiman et al., 2019).

Indonesia is one of the countries where religiosity and religion greatly influence individual food consumption and expenditure (Fahrur et al., 2020). This is because Indonesia is a country where most people follow Islam. Islam has specific rules about how and who can be involved in animal slaughter and food preparation and prohibits certain types of meat or only halal food (UHF Certification Council, 2016). In addition, people will tend to be more consumptive because of the celebration of religious holidays, which are celebrated yearly, namely Eid al-Fitr and Eid al-Adha (Satt, 2017). The Muslim community will buy more food stocks approaching the holiday, thus causing an increase in food prices (Al-Khazali et al., 2017; Yuchel, 2006).

Given the significance of religion in shaping food consumption, this research aims to analyze the level of food expenditure and food security status of Muslim-specific households in Indonesia. The study recognizes that Muslim households might experience unique food-related challenges due to their specific religious dietary requirements, such as prioritizing halal food sources, which may impact both their food expenditure and food security. Food Law No. 18 of 2012 in Indonesia supports the study's focus, as it underscores the role of "individual" factors and "appropriate religious beliefs" in the country's food security framework. By acknowledging the individual's religious considerations in its definition of food security, the law implicitly suggests that factors such as dietary restrictions or preferences based on religious beliefs should be considered when assessing food security. This aspect is particularly relevant to Indonesia, a predominantly Muslim nation, where cultural practices and religious guidelines can significantly influence food choices.

Despite the law's recognition of individual and religious factors, few studies examine the specific impact of religion on household food consumption and security in Indonesia. Previous research highlights that religion can shape consumption behavior across various levels (Al-Hyari et al., 2012; Nasse, 2020), yet studies rarely explore this in-depth for specific religious groups or analyze how these consumption patterns affect household food security. For instance, halal food requirements might limit food options and influence how households allocate their food budget, potentially increasing food expenditures or affecting access to nutritious foods. These choices can have a direct impact on food security, as consumption patterns may shape food availability, affordability and quality for Muslim households (Beckline and Kato, 2014; Heiman et al., 2019).

This research aims to fill this gap by focusing specifically on Muslim households in Indonesia, examining how religious practices influence their food expenditure and security. Such insights are vital given the broader context: more than half of Muslim-majority countries worldwide are food-deficit nations (COMCEC, 2019). In the context of Indonesia, understanding food security for Muslim households can provide a nuanced view of food insecurity risks that might affect the nation's majority population. Furthermore, ensuring food security for these households could contribute to overcoming economic instability and addressing multidimensional crises associated with food insecurity (Global Network Against Food Crises and Food Security Information Network, 2022).

In sum, the objective of this study is to explore the relationship between religiosity and food security among Muslim households in Indonesia. In this study, religiosity refers to the degree of adherence to Islamic beliefs, practices, and values, which influence Muslim households' decisions, including their food expenditure and consumption behaviors. By focusing on Muslim households, it aims to

contribute to more targeted, culturally sensitive approaches to addressing food insecurity, aligning with Indonesia's food security laws and societal needs.

Specifically, the research investigates the impact of religiosity on food security using the Food Consumption Score (FCS), an indicator recommended by the World Food Program (WFP) and the Food and Agriculture Organization (FAO) for assessing household food security. It further employs longitudinal panel data from the Indonesian Family Life Survey (IFLS) for 2007 and 2014, making it one of the few studies to examine the influence of religiosity using this dataset. Additionally, the study applies Propensity Score Matching (PSM) to assess the effect of religiosity on food security, analyzing this impact across three measures of household expenditure and using the FCS to measure overall food security status.

Examining the influence of religiosity in this research is essential as religiosity serves as a significant factor in shaping food consumption behaviors. While most people globally are affiliated with some form of religion, initiatives aimed at understanding food consumption patterns have primarily focused on environmental, economic, and cultural dimensions, often neglecting the role of religion and religiosity (Zamri et al., 2020). This gap has been highlighted by Elhoushy and Jang (2021), who emphasized the need to explore how religious beliefs and levels of religiosity influence food-related decision-making. Religiosity has been found to play a profound role in shaping attitudes and behaviors regarding food consumption and waste generation.

For instance, Hassan et al. (2022) investigated whether and how religious beliefs and levels of religiosity affect food waste in restaurants, comparing Christian, Muslim, and Druze patrons. Their results revealed that religiosity significantly moderates waste behavior, with more religious individuals generating less food waste. This aligns with Islamic teachings, which strongly discourage wastefulness, promote moderation, and emphasize the moral duty to share excess resources with those in need. Specifically, Muslim respondents with higher levels of religiosity exhibited markedly lower food waste compared to their less religious counterparts.

LITERATURE REVIEW

Religion and the individual's level of religiosity influence consumption decisions and patterns significantly. This is because, in Islam, there are religious orders that regulate consumption behavior. The more religious a person is, they will tend to obey religious orders by spending enough money, so those with a high level of religiosity are less likely to be impulsive when purchasing. Individuals with a high level of religiosity tend to behave more disciplined and responsible in managing their consumption patterns (Razak et al., 2023; Vaal et al., 2023).

Socio-economic factors influence food security and individual consumption patterns. The education level of the head of household has a significant influence on household consumption patterns in Thailand. This is because individuals with higher levels of education will think about the nutritional content of the food they consume (Ambali and Bakar, 2014; Koç and van Kippersluis, 2017). Individuals with higher levels of education contribute positively to food accessibility because they can understand and manage the nutrients in the food they eat (Silva et al., 2023). Then, education level was found to influence food security negatively. This means that the higher a person's education, the better food security.

The next important factor that influences consumption patterns is the area of residence. Based on research by Manajit et al. (2020), it was found that age, area of residence, household arrangement, and education are factors that have a significant effect on consumption patterns. The factor of residence between rural and urban areas is related to lifestyle. People who live in rural areas tend to have a different consumption pattern than those who live in urban areas. This is because there are differences in the type of food, clothing, services, and health care and access. Education is considered to have a significant influence on consumption patterns. Research of Damen et al. (2019) showed that mothers

with a higher education were judged to have a better understanding of the quality and needs of consumption compared to mothers with a lower education.

A study conducted by French et al. (2010) and French et al. (2019) found that household income significantly influences consumption patterns because household income affects the calorie intake to be consumed. Therefore, the household with a higher income is considered to have a consumption pattern of consuming more nutritious food intake compared to the household with a lower income.

Furthermore, in a study conducted by Egah et al. (2023) in West Africa, it was found that household income positively influences food security. This means that the greater the household income, the better the food security in the household. Then, marital status and gender are considered to influence food security significantly. Divorced men are considered to have lower food security compared to unmarried men because they experience a decrease in social support, especially from their wives (Franklin et al., 2011; Hanson et al., 2007; Pellón-Elexpuru et al., 2024; Pienaar et al., 2017). A study conducted in South Africa by Sekhampu (2013) found that household size, marital status, employment status, and gender were important factors in household resilience. These variables have a positive influence on food security. However, the variables of household size and marital status have a negative effect on household food security.

METHOD

Data

This study uses panel data from IFLS 2007 and IFLS 2014, which are large-scale multi-topic household and community surveys. This IFLS data was taken from 13 provinces in Indonesia, covering 13,995 households and 43,000 individuals interviewed in 2007 and 15,900 households and 50,580 individuals in 2014 (Strauss et al., 2016). The IFLS has a much information about socio-demographic-economic aspects that are discussed based on household characteristics. One of them is the consumption module which collects information on the value of food purchased in the past week and used in the past week for own production, as well as information on purchases of household and personal care items over the past month as well as the quantity and purchase prices for some staples (Hasanah et al., 2017).

Propensity Score Matching (PSM)

This study uses the Propensity Score Matching method. This method allows selection bias correction by comparing any similar treatment group and control group based on the propensity score (Rosenbaum and Rubin, 2006). The propensity score is the probability of being in a treatment group or a group that is Muslim-specific households depending on the basic characteristics observed.

The PSM method reduces the bias that results from variations in the observed observations. The PSM method has several advantages over the OLS based on Black and Smith (2004) and Ichino et al. (2006). First, PSM limits the analysis to existing observations with common support; that is, PSM ensures that each treatment group is compared with the control group with sufficient overlap in the characteristic distribution of the observed observations (Heckman et al., 1997). Second, PSM does not limit the relationship between families identified as Muslim, with the outcome variable being linear. Third, PSM developed a propensity score index for the treatment and control groups to match. Finally, when households self-select into a program, PSM provides more accurate non-experimental estimates (Dehejia and Wahba, 2002; White, 2006).

$$\Delta Y_i = E\left(\frac{Y_{1i}}{D_i} = 1\right) - E\left(\frac{Y_{0i}}{D_i} = 0\right) \dots\dots\dots(1)$$

Where $D_i = 1$ is household i when there is at least one Muslim family member, and $D_i = 0$ if none,

Y_{1i} is the outcome for the treatment group, and Y_{0i} is the outcome for the control group. PSM estimation is based on the conditional independence assumption, which states that there is a set X of observable covariates such that the potential outcome does not depend on the status of the treatment group.

$$P(X_i) = Pr \{D_i = \frac{1}{X_i}\} \dots\dots\dots(2)$$

In this framework, it is known that the parameter of the results is the average treatment effect in the treatment group or the Average Treatment Effect on the Treated (ATT). These parameters are calculated from the difference between ATT and the control group on a particular propensity score:

$$ATT = E \left[\frac{Y}{D} = 1, P(X) \right] - E \left[\frac{Y}{D} = 0, P(X) \right] \dots\dots\dots(3)$$

Then, logit regression is used to estimate the predicted probability of being a treatment group (D_i), based on a set of X -observable covariates (X_i):

$$PrD_i = 1|X_i\} = \Phi h \beta_i X_i + e \dots\dots\dots(4)$$

Three types of matching algorithms are used in this paper. First, based on the propensity score, nearest neighbor (NN) matching is used to determine the counterfactual conditions for each MSH. Caliper matching is used to overcome the problem where the NN is far away, generating pool matches when using NN matching. Observations in the control group were matched with individuals in the treatment group who were included in the caliper (propensity range) and closest to the propensity score. The matching method in this paper uses a calibration of 0.001. This paper considers the writings of Heckman et al. (1997) so that in comparing each treatment group with the comparison group, the largest weighted group is used, which is allocated to the group with the closest score.

Model Specification

This model uses basic equations to estimate the impact of religious Muslim households. The equation is as follows:

$$Y_{it} = \beta_0 + \beta_1 Religious_{it} + \beta_2 X_{it} + \epsilon_{it} \dots\dots\dots(5)$$

Where Y is the outcome or dependent variables, β_1 is the parameter that captures the impact of the status of religious Muslim households, $Religious$ is the indicator of the individual or household that religious, X is the vector of exogenous covariates that describe the characteristics of the head of the household, household and community.

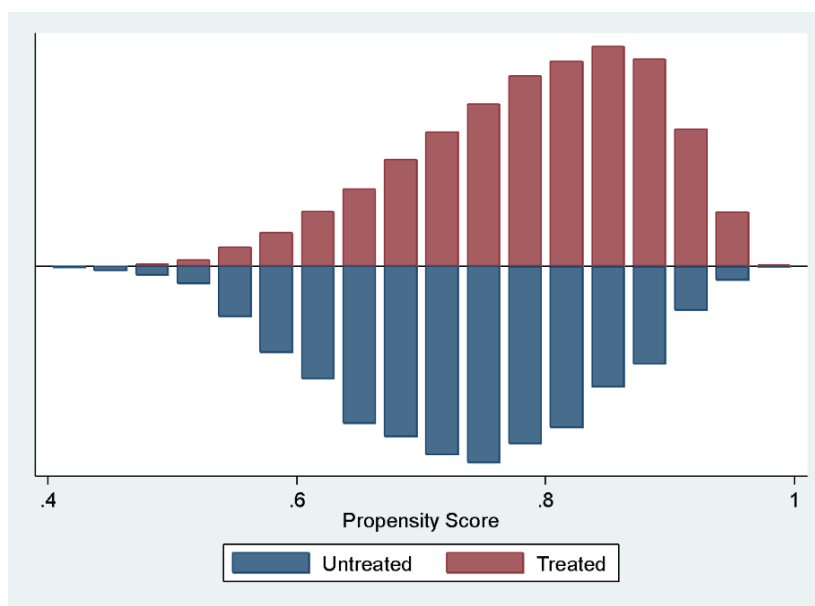
The religiosity variable in this study was derived from IFLS 4 (2007) and IFLS 5 (2014) from Strauss et al. (2016), particularly book 3A section TR11, which contains observations related to religious aspects. This data is limited to households identified as Muslim, as determined by the criteria outlined in section TR12 of the same book. Thus, the variable is specifically designed to represent the level of religiosity within the context of Muslim households in Indonesia. Religion provides general guidelines on dietary laws and ethical behavior, influencing food-related decisions broadly, such as halal consumption in Islam.

Religiosity, however, reflects the degree to which individuals or households internalize and practice these religious beliefs, leading to variations in behavior even within the same faith. Higher religiosity may result in stricter adherence to dietary restrictions, resource allocation for spiritual practices like zakat, or prioritization of food waste reduction, which can impact food security outcomes (Hassan et

al., 2022). This study examines how differences in religiosity perspectives among Muslim households influence their food security, offering a more detailed perspective beyond the general influence of religion.

RESULT AND DISCUSSION

Figure 1 is a histogram showing the estimation results of the propensity scores between the treatment and control groups. Again, it can be seen that there are overlapping propensity scores between treatment and control groups.



Source: Indonesia Family Life Survey (IFLS), 2007 & 2014 (processed data).

Figure 1 Histogram of propensity score distribution for treatment and control groups

Table 1 shows the estimation results using logistic regression (logit) to identify religious Muslim households based on the characteristics of the head of the household and the household itself.

Table 1 Logistic regression model analyzing the characteristics of religious Muslim in Indonesia

Variables	Coefficient	Standard Error
Head of household characteristics		
Age	0.036592***	0.001987
Sex	0.6462074***	0.041924
Marital status (1 if married, 0 otherwise)	0.1074371***	0.052794
Status of work (1 if worker, 0 otherwise)	0.4875867***	0.0901156
Urban	-0.0335107	0.0425222
Years of Schooling	0.0289025***	0.0052905
Household characteristics		
Household size	-0.0401046***	0.0468853
Own house (1 = yes, 0 = no)	0.2909125***	0.0840283
Constant	-0.6446079***	0.1115644
Pseudo-R ² McFadden	0.054	
Pseudo-R ² McKelvey	0.103	
Pseudo-R ² Cragg & Uhler	0.056	
Pseudo-R ² Effron	0.057	
Likelihood ratio test (prob.)	1017.59***	

Note. ***p<0.01, **p<0.05, and *p<0.1

Source: Indonesia Family Life Survey (IFLS), 2007 & 2014 (processed data).

Based on the estimation results, it can be seen that there is a significant effect on the head of the household, including age, gender, marital status, and employment status, as well as years of schooling. Meanwhile, two existing household characteristics, household size (number of family members) and home ownership, showed significant results.

Specifically, the increasing age of the head of the household will affect increasing religiosity, where this factor is significant at the 1% level. This result is in line with research by Bengtson et al. (2015), which states that the older a person is, the more religious that person will be. Then, gender also showed a significant influence at the 1% level. This can be interpreted, if the individual is a woman, then he will tend to be more religious than the individual male gender. This result is in line with research by Carapina (2015) which shows that women will be more religious than men in various religions. The marital status variable also showed significant and positive results at a significance level of 1%, which means that married individuals tend to be more religious than unmarried individuals. Related to this, Jaffar et al. (2019) in his research state that married people will tend to be more religious and live happier.

The characteristics of the household indicate that the larger the size of the household or the greater the number of members in the family, the negative impact on religious status. However, the home ownership variable shows positive and significant results at the 1% level. This can be interpreted as if households have their own house, the household will tend to be more religious.

Table 2 explains the impact of the religious status of Muslim households on monthly food expenditure, food expenditure per capita per month, and total expenditure per capita per month. The estimation is done using PSM with three matching algorithms.

Table 2 Impact of Muslim religious households status in Indonesia on outcome variables

Outcome Variables	PSM Estimates (Average Treatment Effect on the Treated (ATT))					
	Matching Algorithm	Diff.	SE	t-test	Nt	Nc
Monthly Expenditure on Food (Logarithmic Form)	NN Caliper = 0.001 with replacement	-0.03759**	0.01910	-1.97	13.612	3.931
	NN Caliper = 0.001 without replacement	-0.05251***	0.01632	-3.22	13.688	3.931
	Kernel	-0.06830***	0.01465	-4.66	13.688	3.931
Monthly Per Capita Expenditure on Food (Logarithmic Form)	NN Caliper = 0.001 with replacement	-0.05457***	0.01929	-2.83	13.612	3.931
	NN Caliper = 0.001 without replacement	-0.06593***	0.02785	-3.96	13.688	3.931
	Kernel	-0.06017***	0.01479	-4.07	13.668	3.931
Monthly Per Capita Total Expenditure (Logarithmic Form)	NN Caliper = 0.001 with replacement	-0.02077	0.01947	-1.07	13.518	3.903
	NN Caliper = 0.001 without replacement	-0.04465***	0.01645	-2.71	13.623	3.903
	Kernel	-0.03238**	0.01500	-2.16	13.623	3.903

Note. ***p<0.01, **p<0.05, and *p<0.1

Source: Indonesia Family Life Survey (IFLS), 2007 & 2014 (processed data).

The results of this study indicate that the religious status of Muslims negatively affects food expenditure per month, food expenditure per capita per month, and total expenditure per capita per month. These results can be interpreted as religious Muslims spending less than non-religious Muslims. The estimation results show the same sign for all matching algorithms (with replacement, no replacement, and kernel). The results of this study show that Average Treatment Effect on the Treated (ATT) which is in the range of values of -0.02 to -0.06, which indicates the influence of Muslim religious status on households only has a negative influence or expenditures are smaller, ranging from 2% to 6% compared to non-religious Muslim households.

The study's findings, which highlight reduced food and total expenditures among Muslims, align with previous research on the relationship between religiosity and spending habits. Kurt et al. (2018), for example, found that religious Americans often spend less in supermarkets and are less prone to unplanned purchases. This tendency can be seen as part of a broader behavioral pattern among religious individuals who may prioritize intentional, mindful consumption over impulsive or excessive spending. Additionally, dietary restrictions within Islam limit permissible food choices, which could lead to more selective and potentially lower spending. Periods of religious fasting, such as Ramadan, also alter consumption habits, often leading to reduced meal frequencies, which may contribute to a decrease in average food expenditure over time.

Yeniaras and Akarsu (2017) provide additional insight, suggesting that religious Muslims display a heightened sense of frugality and quality consciousness. According to their research, this cautious spending aligns with Islamic teachings, which advocate for quality without indulgence. Specifically, the Qur'an, in Al A'raf 7:31, advises Muslims to dress in quality attire when attending the mosque, but warns against extravagance. This guidance reflects a principle of balance, valuing high standards without crossing into excess. In line with these teachings, many Muslims may apply similar moderation to their daily consumption, focusing on essential needs and maintaining quality while avoiding unnecessary expenditures.

Table 3 Food Consumption Score (FCS) of Muslim religious households status in Indonesia on outcome variables

Outcome Variables	PSM Estimates (Average Treatment Effect on the Treated (ATT))					
	Matching Algorithm	Diff.	SE	t-test	Nt	Nc
FCS Acceptable (FCS=1 if FCS>42)	NN Caliper = 0.001 with replacement	0.01245	0.01310	0.95	13.730	3.957
	NN Caliper = 0.001 without replacement	0.01790*	0.01120	1.64	3.910	3.957
	Kernel	0.011197*	.000984	1.66	13.828	3.957
FCS Borderline (FCS=1 if FCS≥28 & ≤42)	NN Caliper = 0.001 with replacement	0.617844	0.01278	0.67	13.730	3.957
	NN Caliper = 0.001 without replacement	0.00741	0.01095	0.68	3.910	3.957
	Kernel	0.011198*	.000984	1.66	13.828	3.957
FCS Poor (FCS=1 if FCS < 28)	NN Caliper = 0.001 with replacement	-0.00852	0.01278	-0.67	13.730	3.957
	NN Caliper = 0.001 without replacement	-0.00741*	0.01095	-1.67	3.910	3.957
	Kernel	-0.03238**	0.01500	-2.16	13.623	3.903

Note. ***p<0.01, **p<0.05, and *p<0.1

Source: Indonesia Family Life Survey (IFLS), 2007 & 2014 (processed data).

Based on the results of the FCS estimation, it can be seen that the status of a Muslim religious household tends to increase the status of FCS acceptable and FCS borderline (the status of a Muslim religious household has a positive effect on FCS acceptable and FCS borderline status). This pattern indicates that religious Muslim households tend to have adequate or moderate food security more often than their non-religious counterparts, which points to the potential protective effect of religiosity on household food stability.

Islamic teachings emphasize moderation and frugality in consumption, which may encourage more disciplined and thoughtful spending on food. This focus on essentials rather than indulgences can help religious households maintain sufficient food supplies without overextending their budgets. Furthermore, religious Muslim households may benefit from community-based support systems, such as zakat (mandatory almsgiving) and sadaqah (voluntary charity), which offer assistance to individuals facing hardship. This sense of communal responsibility and charitable giving could provide an added layer of food security for religious households, especially during challenging economic times.

CONCLUSION

Specifically, the purpose of this study is to investigate the impact of religiosity on monthly household expenditure on food and aspects of food security using the Food Consumption Score (FCS), which is an indicator of household food security suggested by the World Food Program (WFP) and the Food Organization and Agriculture (FAO). This study uses the PSM method to use panel data from IFLS 2007 and IFLS 2014.

The results of this study are that religious Muslim households tend to have lower food expenditures per month, food expenditures per capita per month, and total expenditure per capita per month are smaller than non-religious Muslim households. In addition, the results of this study indicate that religious Muslim households tend to have better FCS than non-religious Muslim households, where FCS acceptable and borderline FCS status is positively influenced by religious Muslim household status. This study fills the gap by expanding the still limited literature on the influence of religiosity in Muslim households on consumption at the individual and household levels in Indonesia.

Based on the study's findings, policymakers should focus on promoting financial literacy programs that emphasize frugality, resource allocation, and mindful consumption, as these practices are linked to better food security outcomes in religious households. Additionally, fostering community-based support systems, such as collaborating with religious organizations to implement food aid programs, can provide a safety net for vulnerable households, mimicking the positive impacts of charitable practices like zakat and sadaqah. Furthermore, food assistance programs should consider incorporating cultural and religious preferences, such as offering halal food options, to ensure broader participation and inclusivity. Finally, we recommend that further research uses data from more recent years and expands the scope of research, especially with the Muslim majority.

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