

ORIGINAL ARTICLE

Knowledge on Leptospirosis Control and Prevention among Wet Market Workers in Selangor, Malaysia

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ABSTRAK

Leptospirosis ialah penyakit zoonosis yang semakin kerap terjadi di Malaysia, terutamanya dalam persekitaran berisiko tinggi (pasar basah) yang biasanya melibatkan pendedahan kepada air dan sisa haiwan yang tercemar. Pekerja pasar basah amat terdedah disebabkan oleh risiko pekerjaan serta akses yang terhad terhadap pendidikan kesihatan. Sehubungan itu, kajian ini dijalankan untuk menilai tahap pengetahuan berkaitan kawalan dan pencegahan leptospirosis dalam kalangan pekerja pasar basah di Selangor, Malaysia, serta meneliti pengaruh faktor sosiodemografi. Satu kajian keratan rentas telah dijalankan dari Januari hingga April 2025 di beberapa buah pasar basah yang terpilih di daerah Hulu Langat dan Petaling. Seramai 125 orang responden telah dipilih melalui pensampelan bertujuan. Data dikumpulkan dengan menggunakan soal selidik berstruktur yang telah diuji terlebih dahulu, dan ia kemudiannya dianalisis dengan menggunakan statistik deskriptif, ujian-t sampel bebas dan analisis varians sehalu. Kebanyakan responden berumur ≥ 55 tahun (40.8%), bekerja sendiri (99.2%) dan mempunyai tahap pendidikan rendah (44.0%) atau menengah (38.4%). Skor purata pengetahuan keseluruhan ialah 13.98 (SP 5.00) daripada 21. Dapatan ini menunjukkan tahap pengetahuan yang sederhana tentang kawalan dan pencegahan leptospirosis. Walaupun kesedaran mengenai laluan penularan dan pencegahan umum adalah tinggi, pengenalan simptom dan kesedaran diagnostik masih menunjukkan jurang yang ketara. Skor pengetahuan berkaitan amalan pencegahan menunjukkan hubungan signifikan dengan umur ($p = 0.005$), etnik ($p = 0.003$), tahap pendidikan ($p = 0.003$), tempoh bekerja ($p = 0.006$) dan pendapatan ($p < 0.001$). Kesimpulannya, pekerja pasar basah menunjukkan tahap kefahaman yang sederhana berkenaan pencegahan dan kawalan leptospirosis, namun terdapat jurang yang perlu diberikan perhatian dalam usaha untuk mencegah risiko persekitaran dan untuk mengenal pasti penyakit seawal mungkin. Oleh itu, intervensi kesihatan awam perlu memberikan tumpuan kepada golongan dewasa berumur, berpendidikan rendah dan berpendapatan rendah melalui pendekatan pendidikan kesihatan yang disesuaikan mengikut konteks bagi meningkatkan usaha pencegahan penyakit dalam persekitaran pekerjaan yang berisiko tinggi.

Kata kunci: Kesihatan awam; leptospirosis; pengetahuan; pekerja pasar basah; Selangor

ABSTRACT

Leptospirosis is a zoonosis with increasing incidence in Malaysia, particularly in high-risk environments (wet markets) with common exposure to contaminated water and animal waste. Wet market workers are especially vulnerable due to occupational hazards and limited access to health education. Accordingly, we assessed the knowledge related to leptospirosis control and prevention among wet market workers in Selangor, Malaysia and examined the influence of sociodemographic factors thereon. We conducted a cross-sectional study from January to April 2025 at selected wet markets in the Hulu Langat and Petaling districts. We selected 125 respondents through purposive sampling. Data were collected using a structured, pre-tested questionnaire and analysed using descriptive statistics, independent sample t-tests and one-way analysis of variance. Most respondents were aged ≥ 55 years (40.8%), self-employed (99.2%) and had primary (44.0%) or secondary (38.4%) education. The overall mean knowledge score was 13.98 (SD 5.00) out of 21, indicating moderate knowledge of leptospirosis control and prevention. While the respondent's awareness of transmission routes and general prevention was high, their symptom recognition and diagnostic awareness demonstrated substantial gaps. Knowledge of preventive practices scores were significantly associated with age ($p = 0.005$), ethnicity ($p = 0.003$), education level ($p = 0.003$), employment duration ($p = 0.006$) and income ($p < 0.001$). In conclusion, the wet market workers demonstrated moderate understanding of leptospirosis prevention and control, but critical gaps remain in environmental risk prevention and early disease recognition. Thus, public health interventions should target older adults, those with low education and lower-income groups using tailored, context-specific health education strategies to enhance disease prevention efforts in high-risk occupational settings.

Keywords: Knowledge; leptospirosis; public health; Selangor; wet market workers

INTRODUCTION

Leptospirosis is a zoonotic disease caused by pathogenic spirochetes of the genus *Leptospira*. It remains a significant public health concern in many tropical and subtropical countries, including Malaysia, where the climate and environmental conditions are conducive to its transmission (World Health Organisation 2003). The disease is primarily transmitted to humans through direct contact with the urine of infected animals or indirectly via contaminated water, soil or food. Rodents, particularly rats, are the most common reservoirs (Benacer et al. 2016). Symptoms of leptospirosis range from mild flu-like signs to severe complications such as jaundice, kidney failure, liver damage and even death (Costa et al. 2015).

Malaysia has experienced recurring leptospirosis outbreaks, especially during the monsoon season, which leads to environmental flooding and increased human exposure to contaminated water. According to the Ministry of Health Malaysia (2022), leptospirosis has

been classified as a notifiable disease, and incidence rates have continued to rise over the past decade, with thousands of cases reported annually. Selangor, being the most populous state in Malaysia, consistently reports a high number of cases, especially in urban and semi-urban districts such as Hulu Langat and Petaling, where wet markets are densely located (Ab Kadir et al. 2018; Department of Statistics Malaysia 2023).

Wet market environments are particularly conducive to the spread of leptospirosis due to their moist, crowded and often unsanitary conditions, which provide ideal habitats for rodents and facilitate contact between humans and contaminated surfaces or fluids (Mathanamohan et al. 2020). Wet market workers, who are often self-employed and operate in informal settings, represent a high-risk occupational group. These workers frequently handle raw produce, clean water sources and waste without adequate protective measures, exposing them to repeated and prolonged contact with potentially contaminated environments

(Benacer et al. 2016; Samsudin et al. 2020).

Despite the clear occupational risks, there remains a paucity of research in Malaysia specifically assessing the knowledge, awareness and preventive practices of leptospirosis among wet market workers. Previous knowledge, attitudes and practices (KAP) studies conducted among general populations or specific occupational groups, such as farmers and municipal workers, have revealed varying degrees of awareness and significant gaps in knowledge related to transmission, symptom recognition and preventive measures (Azfar et al. 2018; Hassan et al. 2023; Nozmi et al. 2018). These studies consistently indicate that sociodemographic factors such as age, education level, and income are significantly associated with disease knowledge and preventive behaviour (Thung Senket al. 2024; World Health Organisation 2010).

Understanding the level of knowledge among high-risk populations is essential for designing targeted health education programs and interventions. This is particularly important for populations with limited access to formal healthcare systems, low educational attainment and restricted health literacy - all characteristics commonly found among wet market workers (Jaafar et al. 2021; Loganathan et al. 2019). Improving knowledge in this group can lead to better adoption of personal protective behaviours, timely health-seeking actions, and ultimately reduced transmission.

This study aims to assess the knowledge related to leptospirosis control and prevention among wet market workers in selected districts of Selangor, Malaysia. It also seeks to examine the association between knowledge levels and sociodemographic characteristics such as age, gender, education, length of employment and income. The findings are intended to inform context-specific public health strategies and educational interventions aimed at reducing leptospirosis transmission in high-risk occupational settings.

MATERIALS AND METHODS

Study Design and Setting

The state of Selangor has a high incidence of leptospirosis (Ab Kadir et al. 2025) and a significant population of wet market workers (Samsudin et al. 2020). Data were collected using structured questionnaires distributed to wet market workers at selected markets in the Hulu Langat and Petaling districts of Selangor. This study used a cross-sectional design and was conducted between January 27 and April 10, 2025. The Hulu Langat and Petaling districts were selected due to their high population density, the presence of numerous wet markets and previously reported leptospirosis cases, which rendered them high-risk areas for zoonotic transmission (Ab Kadir et al. 2025; Department of Statistics Malaysia 2023).

Study Population and Sampling

The eligibility criteria were Malaysian citizen aged 18-60 years, employed as wet market worker for at least 6 months and provided informed consent. Potential participants who were unable to communicate with the interviewer or absent throughout the data collection period were excluded.

A total of 125 participants were selected using purposive sampling based on the eligibility criteria. The sample size was calculated using a single proportion formula with finite population correction ($N = 304$), assuming a 95% confidence level ($Z = 1.96$), expected prevalence of 0.50, and precision of 0.05, yielding a minimum required sample of approximately 170 respondents (Lemeshow et al. 1990). Despite field constraints and non-response during data collection, 125 respondents were successfully recruited, which was considered adequate for descriptive and inferential analyses.

Wet market workers were approached directly during operational hours by the researchers, who introduced the study, assessed eligibility, and invited those who qualified to participate. The participants were briefed on the study

purpose and confidentiality, and their written informed consent was obtained. Data were collected on-site either through self-administered questionnaires or face-to-face interviews with low-literacy participants.

Instruments

The participants' knowledge regarding leptospirosis was assessed using a structured and pre-tested questionnaire adapted from validated instruments (Wan Mohd Zahiruddin et al. 2018). Content validity was established through expert review during the original instrument development. The original study reported acceptable internal consistency reliability (Cronbach's $\alpha > 0.70$) for the questionnaire domains. The knowledge section contained 21 items evaluating the participants' understanding of leptospirosis, including its name, causative agent, transmission modes, clinical symptoms, risk groups, complications and prevention strategies. Each correct response received 1 point, while incorrect or "not sure" responses received 0 points. The total possible score was 0-21, with higher scores indicating greater knowledge of leptospirosis control and prevention.

Data Analysis

Respondents' sociodemographic characteristics and leptospirosis-related knowledge scores were summarised using descriptive statistics, including frequencies, percentages, means and standard deviations. All data were entered, cleaned and analysed using Statistical Package of Social Sciences, version 26 (SPSS) (IBM Corp., Armonk, NY, USA)

Normality of continuous variables was assessed using skewness and kurtosis statistics. Kolmogorov-Smirnov testing was not emphasised due to its sensitivity in large samples (>100). As the knowledge scores were approximately normally distributed, parametric tests were applied. Associations between knowledge scores and sociodemographic variables were examined using inferential statistical analyses. Mean

knowledge scores across binary variables (e.g., gender and marital status) were compared using independent samples *t*-tests, while variables with more than two categories (e.g., age group, education level, employment duration and income group) were analysed using one-way analysis of variance (ANOVA). When ANOVA indicated statistically significant differences, post hoc comparisons were conducted using Tukey's Honest Significant Difference (HSD) test.

All statistical tests were two-tailed, and a *p*-value of < 0.05 was considered statistically significant. The analysis aimed to identify sociodemographic factors associated with variations in leptospirosis-related knowledge scores to inform targeted public health education and prevention strategies.

Multiple linear regression was considered but not performed due to small subgroup sizes and multicollinearity among the sociodemographic variables. Employment status was excluded from the ANOVA because one category contained only a single respondent.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Universiti Kebangsaan Malaysia Research and Ethics Committee (UKM PPI/111/8/JEP-2023-069) and the Malaysian Ministry of Health Medical Research and Ethics Committee (NMRR-ID-23-01054-DVX). Prior to participation, all respondents were provided with detailed information about the study objectives, procedures, risks and confidentiality assurances. Written informed consent was obtained from each participant before their data were collected.

RESULTS

A total of 125 wet market workers participated in the study (Table 1). Most respondents were older adults, with 40.8% aged 55 years and above and 28.0% aged 45-54 years, while only a small proportion were under 35 years of age. Slightly

TABLE 1: Demographic characteristics of respondents (n = 125)

Characteristic	Category	Total n (%)
Age	18–24 years	5 (4.0)
	25–34 years	12 (9.6)
	35–44 years	22 (17.6)
	45–54 years	35 (28.0)
	55 years and above	51 (40.8)
Gender	Male	68 (54.4)
	Female	57 (45.6)
Ethnicity	Malay	39 (31.2)
	Chinese	65 (52.0)
	Indian	21 (16.8)
Citizenship	Malaysian citizen	125 (100.0)
Marital Status	Single	16 (12.8)
	Married	108 (86.4)
	Others	1 (0.8)
Education Level	No formal education	13 (10.4)
	Primary school education	55 (44.0)
	Secondary school education	48 (38.4)
	Undergraduate (Cert./Diploma/Bachelor's)	9 (7.2)
Occupation	Government employee	1 (0.8)
	Self-employed	124 (99.2)
Length of Employment	0–5 years	13 (10.4)
	6–10 years	17 (13.6)
	11–15 years	11 (8.8)
	16–20 years	31 (24.8)
	21–30 years	53 (42.4)
Monthly Income	< RM500	4 (3.2)
	RM500–RM1000	23 (18.4)
	RM1001–RM2000	63 (50.4)
	RM2001–RM3000	32 (25.6)
	> RM3000	3 (2.4)

more than half of the participants were male (54.4%). The majority were of Chinese ethnicity (52.0%), followed by Malays (31.2%) and Indians (16.8%), and all respondents were Malaysian citizens.

Most participants were married (86.4%). Educational attainment was generally low, with the majority having primary (44.0%) or secondary education (38.4%) and only a small proportion having completed undergraduate-level education (7.2%). Nearly all respondents were self-employed (99.2%). In terms of work experience, most had been employed for more than 15 years, particularly those with 21–30 years of service (42.4%). Monthly income was

predominantly between RM1001 and RM2000 (50.4%), followed by RM2001–RM3000 (25.6%).

Knowledge of Participants Regarding Leptospirosis Control and Prevention Awareness and Sources of Information

Most respondents (87.2%) had heard of leptospirosis (Table 2). Among those who were aware (n = 109), electronic media, such as television and radio were the main sources of information (50.5%), followed by social media platforms (34.9%). Printed materials and health talks were less frequently cited.

TABLE 2: Knowledge regarding leptospirosis control and prevention (n = 125)

Component	Category	Total, n (%)
Have you ever heard of leptospirosis?	Yes	109 (87.2)
	No	16 (12.8)
If yes, source of information about leptospirosis (n = 109)	Electronic media (TV, radio)	55 (50.5)
	Social media (WhatsApp, Facebook, Instagram, Telegram, Twitter, blogs)	38 (34.9)
	Printed materials (newspapers, magazines, posters, pamphlets)	6 (5.5)
	Health talks	6 (5.5)
	Others	4 (3.7)
Leptospirosis is also known as rat urine disease	Correct	74 (59.2)
	Incorrect	7 (5.6)
	Not sure	44 (35.2)
Leptospirosis is caused by bacteria	Correct	80 (64.0)
	Incorrect	13 (10.4)
	Not sure	32 (25.6)
It is a zoonotic disease (transmitted from animals to humans)	Correct	95 (76.0)
	Incorrect	8 (6.4)
	Not sure	22 (17.6)
It can be detected through blood tests	Correct	53 (42.4)
	Incorrect	9 (7.2)
	Not sure	63 (50.4)
Leptospirosis can enter through skin wounds	Correct	106 (84.8)
	Incorrect	5 (4.0)
	Not sure	14 (11.2)
Leptospirosis can enter through eyes, nose, or mouth	Correct	94 (75.2)
	Incorrect	7 (5.6)
	Not sure	24 (19.2)
Leptospirosis can be transmitted through contaminated food/drinks	Correct	84 (67.2)
	Incorrect	7 (5.6)
	Not sure	34 (27.2)
Leptospirosis can be spread by shaking hands with an infected person	Correct	37 (29.6)
	Incorrect	22 (17.6)
	Not sure	65 (52.0)
Warning signs of leptospirosis are as follows:		
Fever	Correct	112 (89.6)
	Incorrect	2 (1.6)
	Not sure	11 (8.8)
Body aches	Correct	103 (82.4)
	Incorrect	6 (4.8)
	Not sure	16 (12.8)
Jaundice	Correct	33 (26.4)
	Incorrect	10 (8.0)
	Not sure	82 (65.6)
Leptospirosis could cause:		
Death	Correct	109 (87.2)
	Incorrect	2 (1.6)
	Not sure	14 (11.2)

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		Total, n (%)
Death	Correct	109 (87.2)
	Incorrect	2 (1.6)
	Not sure	14 (11.2)
Respiratory problems	Correct	71 (56.8)
	Incorrect	7 (5.6)
	Not sure	47 (37.6)
Kidney failure	Correct	53 (42.4)
	Incorrect	9 (7.2)
	Not sure	63 (50.4)
Liver damage	Correct	54 (43.2)
	Incorrect	7 (5.6)
	Not sure	63 (50.4)
Leptospirosis can be avoided by:		
Keep environment clean	Correct	121 (96.8)
	Incorrect	1 (0.8)
	Not sure	3 (2.4)
Avoid flood water	Correct	54 (43.2)
	Incorrect	3 (2.4)
	Not sure	68 (54.4)
Maintain personal hygiene	Correct	120 (96.0)
	Incorrect	0
	Not sure	5 (4.0)
Drink clean water	Correct	122 (97.6)
	Incorrect	0
	Not sure	3 (2.4)
Wear gloves when working	Correct	116 (92.8)
	Incorrect	2 (1.6)
	Not sure	7 (5.6)
Avoid bathing in contaminated rivers/ lakes/waterfalls	Correct	53 (42.4)
	Incorrect	7 (5.6)
	Not sure	64 (51.2)

Knowledge of Disease Cause, Transmission, Symptoms and Complications

More than half of the respondents correctly identified leptospirosis as a bacterial disease (64.0%) and recognised it as a zoonotic infection (76.0%). However, knowledge regarding diagnosis was limited, with only 42.4% aware that leptospirosis can be detected through blood tests, while half of the respondents were unsure. Knowledge of transmission routes was generally good. Most respondents knew that leptospirosis can enter through skin wounds (84.8%) and mucous membranes such as the eyes, nose or mouth (75.2%). Although two-thirds recognised

transmission through contaminated food or drinks (67.2%), only 29.6% correctly identified that the disease cannot be spread through handshaking, indicating uncertainty regarding non-transmission routes.

Fever (89.6%) and body aches (82.4%) were the most commonly recognised symptoms. In contrast, awareness of jaundice as a symptom was low, with only 26.4% responding correctly. While most respondents knew that leptospirosis can be fatal (87.2%), knowledge of specific complications, such as respiratory problems, kidney failure and liver damage was comparatively limited.

Knowledge of Preventive and Control Measures

Awareness of personal and environmental preventive measures was high. Almost all respondents recognised the importance of maintaining a clean environment, practicing personal hygiene, drinking clean water and wearing gloves while working. However, fewer respondents identified avoiding flood water (43.2%) and avoiding bathing in contaminated water bodies (42.4%) as preventive measures, highlighting notable gaps in knowledge related to environmental exposure risks.

The overall mean knowledge score on leptospirosis control and prevention was 13.98 (SD = 5.00), indicating a moderate level of knowledge among respondents. Knowledge scores varied widely, ranging from 0 to 21 (Table 3).

Association between Sociodemographic Factors and Knowledge Scores

Independent samples t-tests showed no significant differences in mean knowledge scores based on gender or marital status (Table 4). Knowledge scores were comparable between male and female respondents. Although single respondents had a higher mean score than married respondents, this difference was not

statistically significant. One-way ANOVA revealed significant associations between knowledge scores and several sociodemographic characteristics (Table 5). Knowledge scores differed significantly by age group, with younger respondents scoring higher than older respondents. The highest mean score was observed among those aged 25-34 years, while the lowest was among those aged 55 years and above.

Significant differences were also observed across ethnic groups, with Malay respondents reporting higher knowledge scores compared to Chinese and Indian respondents. Educational level showed a clear association with knowledge scores, with respondents holding undergraduate qualifications scoring highest and those with no formal education scoring lowest.

Length of employment was significantly associated with knowledge scores, with respondents who had worked for fewer years demonstrating higher knowledge levels than those with longer employment durations. Monthly income was also significantly associated with knowledge scores, with respondents earning RM500-RM1000 reporting the highest scores. No significant differences in knowledge scores were observed by occupation, although interpretation was limited due to the small number of government employees.

TABLE 3: Mean score of knowledge on the control and prevention of leptospirosis (n = 125)

Knowledge Score	Mean	SD	Min	Max
Overall knowledge score	13.98	5.00	0	21

TABLE 4: Knowledge score on leptospirosis control and prevention by gender and marital status (n = 125)

Characteristic	Group	n	Mean (M)	SD	t	p	Mean Difference
Gender	Male	68	13.93	5.23	0.12	0.25	0.11
	Female	57	14.04	4.76			
Marital Status	Single	16	16.94	5.29	2.63	0.43	3.45
	Married	108	13.50	4.83			

*Significant at p < 0.05

TABLE 5: Knowledge score on leptospirosis control and prevention according to respondents' characteristics (n = 125)

Characteristic	Group	n	Mean	SD	CI, 95%		F	p
					Lower limit	Upper limit		
Age	18–24 years	5	17.80	1.79	15.58	20.02	3.86	0.005*
	25–34 years	12	17.83	3.38	15.69	19.98		
	35–44 years	22	14.68	5.17	12.39	16.97		
	45–54 years	35	13.54	4.97	11.84	15.25		
	55 years and above	51	12.68	4.92	11.30	14.07		
Ethnicity	Malay	39	15.95	4.507	14.49	17.41	6.24	0.003*
	Chinese	65	13.59	5.31	12.27	14.90		
	Indian	21	11.52	3.44	9.97	13.09		
Education level	No formal education	13	10.62	3.02	8.79	12.44	4.95	0.003*
	Primary school education					14.39		
	Secondary school education	55	13.18	4.46	11.98	16.82		
	Undergraduate (Cert./Diploma/Bachelor's)	48	15.23	5.49	13.63	20.48		
		9	17.00	4.53	13.52			
Occupation	Government employee	1	21.00	0.00	0.00	0.00	2.00	0.159
	Self-employed	124	13.92	4.98	13.03	14.81		
Length of Employment	0–5 years	13	17.08	4.84	14.15	20.00	3.83	0.006*
	6–10 years	17	14.71	6.09	11.57	17.84		
	11–15 years	11	15.82	3.63	13.38	18.26		
	16–20 years	31	14.65	4.79	12.89	16.40		
	21–30 years	53	12.21	4.51	10.96	13.45		
Monthly Income	< RM500	4	9.00	5.89	0.37	18.37	5.66	<0.001*
	RM500-RM1000	23	16.91	5.42	14.57	19.26		
	RM1001-2000	63	14.40	4.48	13.27	15.53		
	RM2001-3000	32	12.13	4.19	10.62	13.64		
	> RM3001	3	9.00	6.08	-6.1104	24.11		

*Significant at $p < 0.05$

DISCUSSION

Knowledge of Leptospirosis Control and Prevention

This study identified a moderate to good level of knowledge regarding leptospirosis control and prevention among wet market workers (overall mean score: 13.98, SD = 5.00). General awareness of the disease was high, but important gaps were identified in knowledge related to environmental exposure risks, diagnostic methods and recognition of severe symptoms. These findings are particularly relevant given the

occupational setting, where regular exposure to contaminated water, waste and rodents increases the risk of leptospirosis transmission.

Most respondents demonstrated good awareness of basic preventive measures, including maintaining environmental cleanliness (96.8%), practicing personal hygiene, wearing gloves during work (92.8%) and consuming clean water (97.6%). These findings are consistent with previous Malaysian studies that reported a relatively high awareness of hygiene-based preventive practices among high-risk occupational groups (Azfar et al. 2018; Nozmi

et al. 2018). However, fewer respondents recognised avoidance of flood water (43.2%) and bathing in contaminated natural water bodies (42.4%) as important preventive strategies. This gap is concerning, as flood-related exposure has been repeatedly linked to leptospirosis outbreaks, particularly during monsoon seasons (Ab Kadir 2025; WHO 2011). These findings underscore the need for seasonal and context-specific health education focusing on environmental exposure risks.

Knowledge of Participants Regarding Leptospirosis Control and Prevention

Although the primary study focus was on control and prevention knowledge, understanding of disease characteristics provides important context for interpreting preventive behaviours. Most respondents correctly identified leptospirosis as a bacterial zoonotic disease and were aware of common transmission routes, such as entry through skin wounds and mucosal membranes. This suggests reasonable awareness of occupational exposure pathways in wet market environments, which are known reservoirs for *Leptospira* spp. (Benacer et al. 2016; WHO 2003).

Nevertheless, there were notable diagnostic and clinical knowledge gaps. Only 42.4% of the respondents were aware that leptospirosis can be detected through blood tests, and many were uncertain about this diagnostic method. Limited knowledge of diagnostic procedures may delay healthcare-seeking behaviour and contribute to late presentation, especially given that early symptoms often resemble other febrile illnesses such as dengue or influenza (Costa et al. 2015). Furthermore, the respondents' awareness of severe leptospirosis symptoms was limited, with poor recognition of jaundice (26.4% of the respondents) and organ complications, consistent with previous studies reporting inadequate knowledge of advanced disease stages, such as liver and kidney failure (Daher Ede et al. 2016).

Misconceptions regarding person-to-person transmission were evident, with 52.0% of respondents unsure whether leptospirosis could

be spread through handshaking. Previous KAP studies in Malaysia and the Philippines have reported similar misunderstandings, particularly among populations with lower educational attainment (Hassan et al. 2023; Sarkar et al. 2002). These misconceptions highlight the need for clearer public health messaging that differentiates between direct environmental exposure and (indirect) non-transmission routes.

Sociodemographic Factors Associated with Knowledge

Knowledge scores were significantly associated with age, education level, income, ethnicity and length of employment, consistent with broader public health literature indicating that socioeconomic and educational status shape knowledge disparities (Azfar et al. 2018; WHO 2010). Younger respondents (25-34 years old) and those with higher educational attainment demonstrated better knowledge, likely reflecting greater access to health information and higher health literacy due to better digital literacy and access to social media. Furthermore, respondents with shorter employment durations scored higher, possibly due to more recent exposure to health campaigns or workplace training.

An interesting and unexpected finding was that respondents earning RM500-RM1000 (mean score: 16.91) had the highest knowledge scores, while those in the lowest (earning < RM500) and highest (earning > RM3000) income groups scored lower. This may be because middle-income workers are more actively involved in daily wet market operations, resulting in greater occupational exposure and increased engagement with health information or public health messaging. Contrastingly, extremely poor respondents may have limited disease awareness, while higher-income respondents may have less direct involvement in high-risk activities, leading to lower perceived vulnerability and reduced disease-specific knowledge. Other occupational health studies have reported similar patterns, where perceived risk through direct occupational exposure influenced knowledge acquisition and

retention (Mathanamohan et al. 2020).

The knowledge scores were not significantly associated with gender or marital status. Rechecking of the statistical analyses confirmed these findings, and non-significant results were interpreted cautiously to avoid overstatement.

Implications for Public Health Interventions

The findings have important implications for leptospirosis prevention strategies among wet market workers. The gaps in environmental exposure knowledge support the need for targeted interventions such as seasonal health talks, flood-awareness campaigns and workplace-based education during monsoon periods. Limited awareness of diagnostic methods and severe symptoms highlights the importance of brief training sessions focused on early symptom recognition and prompt medical testing.

At the policy level, integrating leptospirosis education into occupational safety regulations for wet markets may enhance the sustainability of preventive efforts. Collaboration between local councils, health departments and market associations could facilitate regular dissemination of culturally appropriate, low-literacy educational materials through both traditional and digital platforms.

In summary, while general awareness of leptospirosis among wet market workers was relatively high, critical knowledge gaps regarding environmental exposure, diagnosis and severe disease manifestations remain. Addressing these gaps through targeted, occupation-specific and seasonally timed interventions is essential to strengthen leptospirosis prevention and control efforts in high-risk settings.

Limitation

Including a willingness to use a mobile health application as an eligibility criterion was part of a broader research framework intended to inform a subsequent digital health intervention. Although this criterion was not applied in the final eligibility assessment for the present analysis, its initial

inclusion may have introduced selection bias by favouring individuals more receptive to digital health approaches, potentially limiting sample representativeness, particularly among older workers or those with lower digital literacy.

In addition, the purposive sampling restricted the generalisability of the findings beyond the selected wet markets and districts, and the cross-sectional study design precluded causal inference between sociodemographic factors and knowledge levels. Multiple linear regression analysis was not performed due to the small subgroup sizes and multicollinearity among the sociodemographic variables. Furthermore, the reliance on self-reported data may have introduced recall or social desirability bias. Despite these limitations, the study provides valuable insights into leptospirosis prevention and control knowledge among a high-risk occupational group and highlights important areas for targeted public health intervention.

CONCLUSION

This study highlights the demographic and occupational vulnerabilities of wet market workers in relation to leptospirosis prevention and control. Most respondents were older, self-employed individuals with low income and educational attainment, factors that collectively increase exposure to occupational health risks and limit access to protective resources. Although overall knowledge of leptospirosis was moderate to good, important gaps remain in clinical recognition, diagnostic awareness and understanding of environmental transmission pathways. These deficiencies were most evident among older workers, those with lower levels of education and lower-income. Hence, public health efforts should focus on strengthening knowledge in these underperforming areas.

The findings underscore the need for targeted, rather than generalised, public health interventions that prioritise these high-risk subgroups. Culturally and contextually appropriate health education initiatives delivered through community-based outreach, workplace

health talks, and accessible media platforms are essential to strengthen knowledge of leptospirosis control and prevention. Integrating occupational health education into routine wet market operations may further support sustained behavioral change.

By addressing identified knowledge gaps and focusing on vulnerable worker groups, these interventions have the potential to reduce leptospirosis incidence, improve occupational safety and inform evidence-based public health policies for high-risk occupational settings.

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Ethics statement: The study was performed in accordance with the Declaration of Helsinki and was approved by the National University

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