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**Research Article**

# Prevalence of Overweight and Obesity and Its Association with Nutrition-related Knowledge, Attitudes and Practices (KAP) Among Malaysian Deaf Adults

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## ABSTRACT

This study examines the prevalence of overweight and obesity and determines the association between nutrition-related Knowledge, Attitudes, and Practices (KAP) and obesity among deaf adults from low-income households in Klang Valley, Malaysia. Using purposive sampling, 120 deaf adults from three community centres participated in this cross-sectional study. Anthropometric measurements and sociodemographic data were taken along with information on nutrition-related KAP were collected via a validated questionnaire with assistance from a certified Malaysian sign language interpreter. The average age of participants was 43.1±10.5 years, with a majority being female, Malay, and educated at the secondary level. Overweight and obesity prevalence reached 58.3%. Mean scores for nutrition-related KAP were 53.1±17.5, 4.2±1.7, and 7.4±2.2, respectively. Lower scores in healthy eating practices were significantly associated with higher odds of obesity after adjusting for age, ethnicity, education years, waist-to-hip ratio and body fat percentage (OR=0.73; 95% CI: 0.55–0.97; $p<0.05$). Poor eating practices are associated with obesity among deaf adults. A targeted nutrition education initiative addressing the specific needs of this population is essential to reduce obesity risks.

## INTRODUCTION

The World Health Organisation (WHO) indicates that hearing impairment is a condition where a person is unable to hear as a normal individual does (WHO 2021). Approximately 1.6 million individuals in Malaysia, representing 7.6% of the population, are affected by auditory disabilities, with 74.4% of them belonging to the Bottom 40% (B40) income households, highlighting the additional challenges faced by this low-income demographic in accessing essential resources (Ministry of Health Malaysia 2019). Deaf people typically use sign language as their main mode of communication. However, limitations in sign language resources and a lack of proficiency in sign language among hearing individuals create significant communication barriers (Alnfiai & Sampali 2017; Yasin *et al.* 2017; Birinci & Sarıçoban 2021). In Malaysia, the Bahasa Isyarat Malaysia or the Malaysian Sign Language, was devised in 1954 after the Federation School for the Deaf (FSD) was established. Subsequently, this has been the primary communication technique among deaf individuals in Malaysia (Meeze *et al.* 2020).

These communication barriers can hinder low-income deaf adults from obtaining health-

related information, leading to gaps in their nutritional Knowledge, Attitudes and Practices (KAP). Evidence from other countries indicates that deaf individuals encounter more obstacles in acquiring health-specific information compared to hearing populations (Kushalnagar *et al.* 2019). This issue is exacerbated in low-income settings, where financial and education constraints further limit access to health education and services. Consequently, improper dietary habits and limited nutritional awareness increase the risk of chronic health issues such as cardiovascular disease, diabetes and obesity. Studies from Greece and the United Kingdom highlight the higher prevalence of overweight and obesity among deaf populations, underscoring the need for targeted interventions (Tsimpida *et al.* 2018; Emond *et al.* 2015). However, there is no study specifically examining the prevalence of obesity among deaf adults in Malaysia.

There is also lack of research focusing on the nutritional status of low-income deaf adults and the role of their nutritional KAP in influencing health-related outcomes. Addressing these gaps is crucial to develop tailored strategies to improve their overall health and reduce the risk of obesity. Therefore, this study aims to determine the prevalence of overweight and obesity and investigate the association between nutrition-related KAP and obesity among deaf adults from low-income households in Klang Valley, Malaysia.

## METHODS

### Design, location and time

This cross-sectional study was conducted among deaf adults from low-income households in Klang Valley, Malaysia, which has a high population of obese and deaf adults. Prior to data collection, invitation letters were sent to five deaf community centres, of which three accepted our invitation. Data collection took place from 3rd April to 30th June 2023 at the three participating deaf community centres in Klang Valley. The study was approved by the Medical Research Ethics Committee (MREC) of Universiti Kebangsaan Malaysia with the ethics code JEP-2023-288. Initially, the participants were informed about the study process by distributing a brief description of the study protocol. Data collection commenced after informed consent was obtained from the participants.

### Sampling

Participants were selected through simple random sampling from the three participating deaf community centres. A list of all eligible individuals who met the inclusion criteria was obtained from each deaf community centre. Each person on the list was assigned a unique number, and a computer-generated random number list was used to select participants across the three deaf community centres. This method ensured that every eligible individual had an equal chance of selection. Selected individuals were then contacted and invited to participate in the study. If a selected participant declined or was unavailable, a replacement was randomly selected from the remaining pool using the same procedure. Inclusion criteria were deaf Malaysian adults aged 21 to 59 years, possessing Malaysian disability cards and having the ability to converse using the Malaysian sign language. Exclusion criteria comprised the presence of another physical handicap apart from deafness as well as kidney and liver conditions leading to fluid retention as body composition results may be impacted.

The formula by Daniel (1999), $n=Z^2 P(1–P)/d^2$ was used to ascertain the adequate sample size for this study, with 95% confidence interval, 80% power and a margin of error (d) of 0.05. Considering the 7.6% incidence of hearing disability in Malaysia, the sample size for this study was 120 participants, accounting for a 10% dropout rate (Ministry of Health Malaysia 2019).

### Data collection

A professional sign language interpreter helped with the data collection. Sociodemographic data, including personal information such as name, age, gender, race, socioeconomic status and education level were obtained through interviews. Subsequently, anthropometric measurements such as height, weight, waist and hip circumferences were measured using the standard procedures (Marfell-Jones *et al.* 2006). Body composition was obtained using Bioelectrical Impedance Analysis (BIA) with a Tanita TBF-400 device (Tanita Corporation, USA). Participants with Body Mass Index (BMI) $\leq 24.9$ kg/m$^2$ and $>24.9$ kg/m$^2$ were categorised as non-obese and overweight or obese, respectively based on WHO classification (Ministry of Health Malaysia 2023b).

A validated version of the nutrition-related KAP of healthy eating questionnaire was adopted for this research. These three domains in this questionnaire were devised and verified by Hassan *et al.* (2015). The questionnaire was administered in Malaysian Sign Language and was presented in the Malay language to ensure clarity and accessibility for the participants. A pilot study performed by the researchers on 20 deaf individuals revealed the Cronbach Alpha values for the three domains, namely nutrition-related knowledge domain, attitudes towards healthy eating domain and practices of healthy eating domain were 0.71, 0.72 and 0.67, respectively, suggesting good acceptance and reliability. Nutrition-related knowledge was evaluated using 11 objective questions having True or False answers, covering topics such as food group servings, sources of macronutrients, the role of dietary components such as carbohydrates, proteins, and fats, as well as the importance of food labels in making healthy choices. Correct and incorrect answers were encoded as 1 and 0, respectively.

The attitude section comprised 8 questions that required responses in the form of "agree" or "disagree"; this portion had minimum and maximum scores of 0 and 8, which assessed the perceptions of healthy eating, willingness to adopt dietary changes and habits such as reading nutrition labels and reducing salt or sugar intake. There were 12 questions related to practices of healthy eating that required objective “Yes” or “No” answers, which examines eating behaviours such as meal frequency, breakfast consumption, food choices for main meals and preference for home-cooked versus outside food. This section was scored with minimum and maximum values of 0 and 12. The overall KAP score was expressed as a percentage value and categorised as poor (50% and below) and good (50% and above) KAP related to healthy eating (Hassan *et al.* 2015).

**Data analysis**

Statistical Package for the Social Science (SPSS) version 26.0 was used for data analysis. A normality test was conducted prior to statistical tests, and normal distribution was observed for demographic (age, education years, household income), anthropometric (weight, height, BMI), body fat percentage, waist and hip circumference, waist-to-hip ratio) and questionnaire-derived (knowledge, attitude and practice scores) variables. Descriptive tests were performed to evaluate the mean, standard deviation, and percentage of sociodemographic data, as well as anthropometric profiles and KAP scores. Moreover, the KAP scores (continuous variable) and their association with obesity (categorical variable: non-obese and overweight/obese) among deaf adults from low-income households were evaluated using binary logistic regression.

Sociodemographic and anthropometric factors were included as covariates to control for potential confounding influences on the associations with obesity. Age (in years), ethnicity (Malay ethnic as reference) and education years (measured in completed years of formal schooling) were incorporated as key sociodemographic indicators, given their established relationships with odds of obesity (Mohd-Sidik *et al.* 2021). Additionally, two anthropometric parameters, namely body fat percentage and waist-to-hip ratio, were included due to their direct relevance to obesity and metabolic health (WHO 2011). The number of covariates included in the analysis was limited to a maximum of 6 to adhere to the recommended guidelines for binary logistic regression analysis (Peduzzi *et al.* 1996).

## RESULTS AND DISCUSSION

Majority (58.3%) of the 120 participants were reported to be overweight (30.0%) or obese (28.3%). The mean age of participants was 43.1±10.5 years, with the majority being females (54.2%), Malays (76.7%) and had a secondary education level (74.2%). A significant difference was present regarding ethnic distribution ($p=0.003$), where a more significant percentage (87.5%) of Indian and Chinese participants were obese or overweight (Table 1).

Table 2 summarized the scores and classifications of KAP related to healthy eating among non-obese and overweight or obese participants. Overweight or obese participants exhibited significantly poorer knowledge ($p<0.001$), attitude ($p<0.05$), and practice ($p<0.001$) scores compared to non-obese participants.

Table 3 illustrates the responses provided by the participants regarding KAP associated with healthy eating. In the context of knowledge regarding healthy eating, the majority of the non-obese participants precisely determined

**Table 1. Characteristics of the study participants according non-obese and overweight/obese group**

| Characteristics | All (n=120) | Non-obese (n=50) | Overweight/Obese (n=70) | *p* |
|---|---|---|---|---|
| Gender (n (%)) | | | | |
| Male | 55 (45.8) | 21 (42.0) | 34 (48.6) | 0.476 |
| Female | 65 (54.2) | 29 (58.0) | 36 (51.4) | |
| Age (years) | | | | |
| Mean±SD | 43.1±10.5 | 42.1±11.6 | 43.9±9.6 | 0.359 |
| (Min.–Max.) | (20–59) | (20–59) | (24–59) | |
| Ethnicity (n (%)) | | | | |
| Malay | 92 (76.7) | 46 (92.0) | 46 (65.7) | |
| Chinese | 16 (13.3) | 2 (4.0) | 14 (20.0) | 0.003** |
| Indian | 12 (10.0) | 2 (4.0) | 10 (14.3) | |
| Household Income (USD) | | | | |
| Mean±SD | 329.03±823.07 | 309.96±686.55 | 342.64±908.16 | 0.344 |
| (Min.–Max.) | (0–1,134.43) | (68.07–794.10) | (0–1,134.43) | |
| Education years (years) | | | | |
| Mean±SD | 14.4±1.8 | 14.1±1.9 | 14.6±1.6 | 0.126 |
| (Min.–Max.) | (9–18) | (9–18) | (9–18) | |
| Education level (n (%)) | | | | |
| Primary | 6 (5.0) | 4 (8.0) | 2 (2.9) | |
| Secondary | 89 (74.2) | 38 (76.0) | 51 (72.9) | 0.418 |
| Tertiary | 25 (20.9) | 8 (16.0) | 17 (24.3) | |
| Weight (kg) | | | | |
| Mean±SD | 69.5±15.5 | 57.5±9.0 | 78.1±13.2 | <0.001* |
| (Min.–Max.) | (37.7–121.6) | (37.7–80.4) | (45.6–121.6) | |
| Height (cm) | | | | |
| Mean±SD | 159.4±10.0 | 158.7±9.4 | 159.9±10.5 | 0.524 |
| (Min.–Max.) | (130.6–182.0) | (142.4–182.0) | (130.6–180.0) | |
| BMI (kg/m$^2$) | | | | |
| Mean±SD | 27.2±5.1 | 22.7±2.0 | 30.5±4.1 | <0.001* |
| (Min.–Max.) | (17.4–43.5) | (17.4–24.9) | (25.2–43.5) | |
| Body fat percentage (%) | | | | |
| Mean±SD | 34.6±9.3 | 28.7±8.3 | 38.7±7.6 | <0.001* |
| (Min.–Max.) | (10.9–56.1) | (10.9–40.5) | (24.5–56.1) | |
| Waist circumference (cm) | | | | |
| Mean±SD | 91.3±11.7 | 81.7±7.9 | 98.1±8.9 | <0.001* |
| (Min.–Max.) | (65.2–131.0) | (65.2–99.5) | (76.0–131.0) | |
| Hip circumference (cm) | | | | |
| Mean±SD | 101.5±9.5 | 94.8±5.4 | 106.3±8.9 | <0.001* |
| (Min.–Max.) | (80.4–131.9) | (80.4–106.0) | (90.0–131.9) | |
| Waist-to-hip ratio | | | | |
| Mean±SD | 0.89±0.08 | 0.86±0.06 | 0.93±0.08 | <0.001* |
| (Min.–Max.) | (0.73–1.14) | (0.73–0.99) | (0.77–1.14) | |

SD: Standard Deviation; BMI: Body Mass Index; USD: U.S Dollar; Min.: Minimum; Max. Maximum; Significant at p<0.05 using independent samples T-test (*Continuous data) and Pearson's Chi-square test (**Categorical data)

**Table 2. KAP scores and classifications according to non-obese and overweight/obese group**

| Variables | All (n=120) | Non-obese (n=50) | Overweight/Obese (n=70) | *p* |
|---|---|---|---|---|
| Knowledge percentage (Mean±SD) | 53.1±17.5 | 60.2±14.1 | 48.1±18.0 | <0.001* |
| Good (n (%)) | 56 (46.7) | 27 (54.0) | 29 (41.4) | 0.174 |
| Poor (n (%)) | 64 (53.3) | 23 (46.0) | 41 (58.6) | |
| Attitude score (Mean±SD) | 4.2±1.7 | 4.5±1.4 | 3.9±1.8 | 0.04* |
| Good (n (%)) | 78 (65.0) | 43 (86.0) | 35 (50.0) | <0.001** |
| Poor (n (%)) | 42 (35.0) | 7 (14.0) | 35 (50.0) | |
| Practice score (Mean±SD) | 7.4±2.2 | 8.4±1.9 | 6.7±2.1 | <0.001* |
| Good (n (%)) | 76 (63.3) | 41 (82.0) | 35 (50.0) | <0.001** |
| Poor (n (%)) | 44 (36.7) | 9 (18.0) | 35 (50.0) | |

SD: Standard Deviation; KAP: Knowledge, Attitude, and Practise; Significant at p<0.05 using independent samples T-test (* Continuous data) and Pearson's Chi-square test (** Categorical data)

the suggested servings based on different food groups in the food pyramid as compared to overweight or obese participants. Furthermore, non-obese participants (74.0%) exhibited a stronger mindfulness of the precise position of salt, fat, oils, and sugar in the food pyramid than overweight or obese participants (17.1%). Hence, the non-obese participants (74.0%) had a stronger awareness of the risks related to high salt consumption than the obese or overweight participants (28.6%).

Considering healthy eating attitudes, a more significant fraction of the overweight and obese participants (88.6%) was willing to change eating habits for health benefits, as compared to the non-obese population (70.0%). Notably, a stronger fraction of non-obese participants (74.0%) indicated relative ease of reducing salt, sugar, and artificial flavourings in food than the overweight or obese participants (40.0%). Furthermore, both groups comprised a significant percentage of participants who ate at fast food joints despite knowing the health impact. This percentage was mildly higher for the overweight or obese group (74.0%).

Considering healthy eating practices, participants from both non-obese and overweight or obese groups exhibited a mild propensity for skipping their meals. Non-obese participants (66.0%) are likely to have healthier breakfast choices, such as soup noodles, white rice with dishes or bread, than the overweight or obese participants (42.9%). Similar trends were observed for lunch and dinner, where a higher proportion of non-obese participants (84.0% and 70.0%, respectively) opted for balanced meals. In contrast, overweight/obese participants demonstrated a greater preference for high-fat and processed foods, including fast food, fried noodles and sweetened kuih or desserts, across all main meals, contributing to the lower practice scores observed among the overweight/obese group.

Binary logistic regression was utilized to explore how nutrition-related KAP relates to obesity (Table 4). The analysis was adjusted for various factors, including age, ethnicity, education years, waist-to-hip ratio and body fat percentage. In the initial model (Model 1), lower scores in healthy eating practices were significantly associated with higher odds of obesity (OR=0.77, 95% CI: 0.61–0.97, p<0.05). This association is also significant in the fully adjusted model (Model 3) (OR=0.73, 95% CI: 0.55–0.97; p<0.05).

The outcomes of this study suggested that majority of deaf adults (58.3%) were overweight or obese. This aligns with the observations of the Malaysian National Health and Morbidity Survey (NHMS) of 2023, which indicated that 54.4% of Malaysia adults were overweight or obese (Ministry of Health Malaysia 2023a). Furthermore, the observation also aligns with several studies conducted in Greece and the United Kingdom, where deaf populations were found to be more overweight and obese, with 71.0% and 76.7% prevalence, respectively (Tsimpida *et al.* 2018; Emond *et al.* 2015). The high likelihood of overweight or obese status in deaf individuals may

**Table 3. Responses to the KAP statements related to healthy eating among non-obese and overweight/obese participants**

| Knowledge (Number of correct responses) | Non-obese (n=50) | Overweight/ Obese (n=70) |
|---|---|---|
| Based on food pyramid, rice, noodle, bread, cereals and tubers are recommended to be taken between 8–11 servings per day. | 34 (68.0) | 15 (21.4) |
| Rice and bread contain more carbohydrate compared to fruits and vegetables. | 41 (82.0) | 60 (85.7) |
| Based on food pyramid, vegetables and fruits are recommended to be taken in plenty amount which is at least five servings per day. | 33 (66.0) | 19 (27.1) |
| Based on food pyramid, fish, meat, poultries, eggs, nuts and legumes are recommended to between 3–4 servings per day. | 20 (40.0) | 20 (28.6) |
| Fish, meat, poultries, eggs, nuts and legumes are sources of protein. | 23 (46.0) | 36 (51.4) |
| Based on food pyramid, milk and milk products are recommended to be taken 1–3 servings per day. | 21 (42.0) | 25 (35.7) |
| Sweetened condensed milk or filled milk are categorized as milk or dairy product. | 10 (20.0) | 25 (35.7) |
| Based on Malaysian food pyramid, sugar, salt, fat and oil are located on the lowest level. | 37 (74.0) | 12 (17.1) |
| High salt intake increases risk of hypertension. | 37 (74.0) | 20 (28.6) |
| Unsaturated fat is found in vegetable oils such as olive oil and sunflower oil. | 28 (56.0) | 28 (40.0) |
| Nutrition information panel helps me comparing nutrient contents in two same foods but different brands. | 22 (44.0) | 28 (40.0) |
| **Attitude (Number of positive responses)** | **Non-obese (n=50)** | **Overweight/ Obese (n=70)** |
| Eating habit based on food pyramid is not an important thing for me. | 43 (86.0) | 65 (92.9) |
| I do not need to take vitamins or other dietary supplements if I eat all combination of food based on Malaysian food pyramid. | 46 (92.0) | 63 (90.0) |
| I weigh myself frequently as it is the best way to maintain body weight in a healthy range. | 20 (40.0) | 34 (48.6) |
| I choose to drink plain water instead of carbonated drink or sugary drink. | 47 (94.0) | 64 (91.4) |
| Limiting the use of salt, sugar, sauce, additional flavouring like cencaluk and belacan are easy steps for me to lead to a healthy lifestyle | 37 (74.0) | 28 (40.0) |
| I am willing to change my eating pattern to a healthier pattern in order to improve my own health status. | 35 (70.0) | 62 (88.6) |
| I read the Nutrition Information Panel on foods before choosing healthy food. | 22 (44.0) | 27 (38.6) |
| I choose to eat at fast food restaurants even though I know it encourages an unhealthy eating culture. | 37 (74.0) | 51 (72.9) |
| **Practice (Number of "Yes" responses)** | **Non-obese (n=50)** | **Overweight/ Obese (n=70)** |
| Do you usually skip breakfast? | 5 (10.0) | 10 (14.3) |
| Do you usually skip lunch? | 1 (2.0) | 2 (2.9) |
| Do you usually skip dinner? | 6 (12.0) | 8 (11.4) |
| Do you usually eat fried noodles or fried rice or roti canai or fast food or fried snacks for breakfast? (High fat) | 7 (14.0) | 18 (25.7) |
| Do you usually eat soup noodles or white rice with dishes or biscuits or breads for breakfast? (Healthy) | 33 (66.0) | 30 (42.9) |
| Do you usually eat sweetened kuih or desserts for breakfast? (High sugar) | 5 (10.0) | 12 (17.1) |
| Do you usually eat fried noodles or fried rice or roti canai or fast food or fried snacks for lunch? (High fat) | 6 (12.0) | 25 (35.7) |
| Do you usually eat soup noodles or white rice with dishes or biscuits or breads for lunch? (Healthy) | 42 (84.0) | 36 (51.4) |
| Do you usually eat sweetened kuih or desserts for lunch? (High sugar) | 1 (2.0) | 7 (10.0) |
| Do you usually eat fried noodles or fried rice or roti canai or fast food or fried snacks for dinner? (High fat) | 9 (18.0) | 28 (40.0) |
| Do you usually eat soup noodles or white rice with dishes or biscuits or breads for dinner? (Healthy) | 35 (70.0) | 32 (45.7) |
| Do you usually eat sweetened kuih or desserts for dinner? (High sugar) | 0 (0.0) | 2 (2.9) |

KAP: Knowledge, Attitude, and Practice

**Table 4. The association between nutrition-related KAP and obesity**

| Variables | Model 1[a] | Model 2[b] | Model 3[c] |
|---|---|---|---|
| | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| Knowledge | 0.97 (0.95–1.00) | 0.98 (0.95–1.01) | 0.98 (0.94–1.01) |
| Attitude | 1.00 (0.98–1.02) | 1.00 (0.98–1.02) | 0.99 (0.96–1.02) |
| Practice | 0.77 (0.61–0.97)* | 0.77 (0.60–0.98) | 0.73 (0.55–0.97)* |
| Age | | 1.04 (1.00–1.08) | 1.00 (0.95–1.05) |
| Ethnicity | | 2.17 (0.90–5.24) | 1.94 (0.60–6.30) |
| Education years | | 1.23 (0.97–1.56) | 1.12 (0.83–1.50) |
| Waist-to-hip ratio | | | 1.39 (0.48–3.98) |
| Body fat percentage | | | 1.17 (1.09–1.25)** |

[a]: Initial model; [b]: Adjusted for age, ethnicity and education years; c: Adjusted for age, ethnicity, education years, waist-to-hip ratio and body fat percentage; Significant at *p<0.05; **p<0.001; KAP: Knowledge, Atitude, and Practice; OR: Odds Ratio; CI: Confidence Interval

be attributed to low cognisance and reachability of health-specific promotion communications, specifically healthy eating, which is typically directed towards individuals with normal hearing ability (Emond *et al.* 2015). Moreover, health-related outcomes may also be affected by education level, as indicated by McKee *et al.* (2014), where deaf individuals having lower educational qualifications were at an elevated likelihood for cardiovascular diseases than those with higher education levels.

More findings from this study revealed that most participants answered only half the questions regarding healthy eating, likely due to low literacy levels, as most deaf individuals read at a fifth or sixth-grade level, even into adulthood (Choi *et al.* 2023; ; Rogers *et al.* 2018). Despite secondary education, communication barriers and limited sign language resources restrict access to healthcare knowledge and services, leaving deaf individuals with lower health awareness than hearing populations (Naseribooriabadi *et al.* 2017). As reported by Nor *et al.* (2023), adolescents struggle to interpret nutritional values, such as calorie and carbohydrate amounts in certain food labels, citing reasons such as lack of health concerns and insufficient knowledge. A study among American Sign Language (ASL) users found that deaf individuals are 7 times more likely to lack health knowledge than hearing individuals (McKee *et al.* 2015). In Malaysia, the segregation of deaf students in classrooms limits exposure to health-related discussions and campaigns (Miles *et al.* 2018). Additionally, "dinner table syndrome" and misinformation further hinger health literacy and access to reliable information (Kuenburg *et al.* 2016; Meek 2020; McKee *et al.* 2019). Translation alone also fails to address cultural and experiential differences of deaf individuals (Morisod *et al.* 2022; Young *et al.* 2016; Young *et al.* 2019).

This study also found a single-point decrease in healthy eating practices increased obesity odds by 37%. Poor eating habits, marked by consumption of animal-based foods, refined grains, and sugar, contribute to positive energy balance and obesity. Animal-based diets are often high in saturated fats as well as simple carbohydrates such as refined grains and sugar could contribute to increased BMI and waist circumference which are linked to obesity (Saintila *et al.* 2024). Additionally, the availability of inexpensive, energy-dense foods exacerbates poor eating habits (Malik *et al.* 2020). Malaysian adults from low-cost housing areas face similar issues, with diets high in energy-dense foods but low in nutrient quality and key micronutrients like calcium, folate and vitamin A (Sharif *et al.* 2016). Limited consumption of fruits and vegetables and higher intake of Sugar-Sweetened Beverages (SSB) and processed foods, driven by cost, availability and taste, further worsen dietary practices and obesity rates (Eng *et al.* 2022; Sharif *et al.* 2016).

This is the first work that determine the prevalence of overweight and obesity as well as its association with KAP on healthy eating among deaf adults in Malaysia. Nevertheless, this work has some limitations. The cross-sectional characteristics of this work were unable to

establish cause-effect relationships regarding the degree of nutrition-related KAP among deaf adults' anthropometric profiles and obesity prevalence. To address this limitation, future research could incorporate longitudinal or experimental designs, allowing for a more robust analysis of how nutrition-related KAP impact obesity risk over time among deaf adults. Moreover, eating practices were assessed based on questionnaire responses without comprehensive quantification of healthy food intake. Employing more detailed dietary assessment tools, such as food diaries or habitual dietary records would enable a more precise evaluation of participants' dietary patterns.

## CONCLUSION

The prevalence of overweight and obesity among the deaf population from low-income households in Klang Valley, Malaysia was 58.3%. In the context of healthy eating, a lower score in healthy eating practices indicated a 37% increase in the odds of obesity after possible confounding variables were accounted for. The outcomes of this study highlight the criticality of improving the health of the underserved, particularly low-income deaf communities, who face compounded challenges due to limited access to health-related information and resources. These findings provide essential insights for authorities to develop targeted dietary guidelines and interventions tailored to the unique needs of this vulnerable group.

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## DECLARATION OF CONFLICT OF INTEREST

The authors have no conflict of interest.

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