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Original Article

# Relationship Between Parents' and Indigenous Children's Food Habits and Physical Activity

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**Abstract**

**Background:** The surrounding domestic environment influences the indigenous children's nutrition behaviour. This study examines the relationship between parental nutrition behaviour and children's food habits and physical activities. **Methods:** A cross-sectional study was conducted among 146 indigenous parents and children from indigenous primary schools in Negeri Sembilan, Malaysia. A pre-tested and self-administered questionnaire was utilized to assess the food habits and physical activities among targeted parents and children. **Results:** Parental healthy nutrition behaviour, including the parents' vegetables and fruits consumption were positively and significantly correlated with the children's healthy food habits, vegetables and fruits consumption, as well as the children's physical activities after adjusted for selected socio-demographic variables. Besides, parental physical activity was positively correlated with the children's physical activities ($r = 0.139$, $p = 0.044$). **Conclusion:** The promotion of the parents' fruits and vegetable consumption, and physical activity enhances the children's healthy food habits and physical activities.

***Keywords:*** *Food Habits; Fruits and Vegetables; Nutrition Behaviour; Physical Activity*

## Introduction

Nowadays, the domestic environment is influencing the food habits and physical activity of children, and it is considered among the factors which affect the indigenous community. Indigenous people, also known as Orang Asli, consist of eighteen ethnic groups that are divided into three major tribe groups, namely Semang, Negrito, and Proto Malay in Malaysia (Ahmad *et al*., 2021). The indigenous communities in Malaysia faced different types of health challenges, among which malnutrition is considered a historical major public health concern among the children of that community (Ersado, 2022). While malnutrition consists of distinctive nutritional status outcomes, this study focuses on the behavioural factors related to food habits and physical activity rather than direct nutritional status assessment. Stunting, wasting, underweight, and micronutrient deficiencies are categorised as undernutrition, while overweight, obesity, and diet-related non-communicable diseases represent overnutrition (Basu *et al*., 2025). These nutritional conditions are closely associated with daily dietary intake, such as regular food choices and physical activity status (Feng, 2025). The physical activity can be broadly categorised into three intensity levels, namely sedentary, moderate and vigorous (Clavero-Jimeno *et al*., 2024). However, among the indigenous children, food habits and physical activity may differ from those living in urban areas, which can be explained in terms of different habitual decisions and cultures (Hanemaayer *et al*., 2022). Parental behaviours are considered to assist in the survival or

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welfare of their young ones, and their nutrition behaviours, such as nutrition knowledge, healthy food habits, and the percentage for being physically active, are different due to their socioeconomic variables, cultural differences, and psychological factors (Karimi *et al*., 2023). Therefore, understanding behavioural factors within households, such as parental food habits and physical activity, may complement initiatives through informed preventive and family-centred approaches rather than a clinical nutritional assessment.

In 2012, a study conducted among Krau Wildlife Reserve indigenous children reported that the prevalence of underweight and stunting among those aged one to six years was 50.9% and 61.6%, respectively (Chua *et al*., 2012). While another study by Wong *et al*. (2015) reported that the underweight and stunting group prevalence rates were increased to 54.4% and 64.2%, respectively (Chua *et al*., 2012) and 3.9% of the indigenous children were reported at risk of overweight, and 1.3% of them faced overweight (Wong *et al*., 2015). Therefore, the persistent burden of undernutrition and the emerging risk of overweight among indigenous children emphasise on the importance of understanding the household and behavioural factors related to the children's diet and physical activity.

As the malnutrition prevalence rate among indigenous children has increased over the years, the Malaysian government has initiated strategies to reduce the outcomes associated with malnutrition (Chew *et al*., 2022). The Community Feeding Program has been implemented to rehabilitate undernourished indigenous children by improving their nutritional status. In this program, volunteers feed the indigenous children accompanied by their mothers or the children's guardians and provide education related to nutrition, health, cleanliness, and natural food resources. The malnourished children were also given Ready-to-Use Therapeutic Food (RUTF), milk, and complementary foods. The target coverage of more than 95% was achieved in 2014. Besides, the government has also implemented poverty eradication and welfare programs among aborigines (Abas *et al*., 2020). The aim of these programs was to solve the persistent socioeconomic inequalities and improve the standard of quality of life for Aborigines, thus improving their nutritional status (Chew *et al*., 2022; Kuralneethi *et al*., 2022).

Furthermore, in terms of the anthropometry indicators, the children's nutritional status and health outcomes can be measured by anthropometry measurements, which included body mass index-for-age, weight-for-age, height-for-age, and skinfold thickness (Tay *et al*., 2022). Based on these indicators, undeniably, poor and unbalanced food habits and low physical activity status contribute to malnutrition among the children. However, these two factors are considered to be influenced by parental behaviours as they act as role models for their children, as children lack the capability to consider the proper behaviour for their age; therefore, parents have an impactful influence on their children. Parents' food habits and physical activity patterns are associated with children's nutritional status, as they might follow healthy or unhealthy behaviours according to their surroundings (Ulaganathan *et al*., 2020).

Since malnutrition prevalence among indigenous children in Malaysia has been increasing over the years, the government has implemented a few strategies to reduce the problem, and thus the target coverage has increased slowly over the years. A study reported that there was a decrease in the prevalence ranging from 35.6% to 22.9% in stunting among Aboriginal children (Murtaza *et al*., 2018). Unlike previous research that studied primarily nutritional outcomes or the role of the mothers only, this study focuses on both mothers and fathers as well as other caregivers in Orang Asli households in Malaysia. Ultimately, this study focuses on the association between parental behaviours and indigenous children's food habits and physical activity and provides an understanding of how parenting behaviours affect the children's health in an indigenous setting.

## Materials and Methods

### *Study Design and Respondents*

This was a cross-sectional study conducted in three indigenous primary schools in Negeri Sembilan, Malaysia. The indigenous children were aged 7 to 12 years old, and their respective parents were

recruited using the convenience sampling method. Malay Islamic students and those who cannot converse in Bahasa Melayu or English were excluded from this study.

The sample size was determined using the (Krejcie & Morgan, 1970), and 211 indigenous parents and children were recruited.

Ethical approval was obtained from the National Medical Research Register (NMRR-20-964-47990), while the approval to conduct this study was obtained from the Department of Orang Asli Development (JAKOA/PP.30.049Jld 44(46)).

*Study Instrumentation*

A pre-tested and self-administered questionnaire with four main sections was used for this study. The socio-demographic background was assessed under section A, followed by section B, which assessed parental nutritional behaviours (7 items); section C was used to determine the children's food habits (5 items); and section D evaluated the children's physical activities (14 items) using a 4-point Likert scale.

*Data Collection Procedures*

The self-administered approach was chosen to obtain primary data from the participants. Prior to their participation, consent was obtained, and the participants acknowledged their involvement in this study. Besides, for those who were unable to recognise and read the words, a face-to-face interview was carried out, as it allows them to clarify the questions, and at the same time, a higher response rate was anticipated. During the interview process, the questions were asked mostly in Malay rather than English. This step was to ensure proper responses were received to fulfil the objective of this study.

*Statistical Analysis*

Statistical analysis was performed with SPSS version 23.0 with a significance threshold set at $p < 0.05$. The normality test was scrutinised before the inferential analysis. Descriptive analysis was presented in mean and standard deviation, or median and interquartile range, frequency, or percentage. Pearson correlation was used to test the correlation between two variables, and partial correlation analysis was performed to assess the correlation between parental nutritional behaviour and children's food habits and physical activity after adjusting for selected sociodemographic data.

## Results

*Characteristics of Study Respondents*

In terms of the gender distribution, 51.2% (n = 108) of the participants were male, while 48.8% (n = 103) were female. There were 55% (n = 116) aged between 10 and 12 years old, while 45% (n = 95) were between 7 and 9 years old. The majority (71.6%; n = 151) were mothers of the indigenous children, followed by self-employed (49.8%; n = 105) and married (87.2%; n = 184) with five or more than five family members (71.6%; n = 151) who earned less than RM1000 income monthly (75.4%; n = 159) or those from the Temuan sub-tribe (91.9%; n = 194). The majority of parents had completed the primary educational level (48.3%; n = 102), while 46.9% (n = 99) had the secondary education level, and a minority of them (4.7%; n = 10) had completed tertiary education, as shown in Table 1.

***Table 1:*** *Socio-demographic Background of Parents and Children*

| **Characteristics** | | **n (%)** |
|---|---|---|
| Age (Years) of Children | 7 to 9 | 95 (45) |
| | 10 to 12 | 116 (55) |
| Gender of Children | Male | 108 (51.2) |
| | Female | 103 (48.8) |
| Relation with Children | Mother | 151 (71.6) |
| | others | 60 (28.4) |
| Employment Status | Housewife | 73 (34.6) |
| | Self-employment | 105 (49.8) |
| | Government | 19 (9) |
| | Private sector | 14 (6.6) |

| | | |
|---|---|---|
| Parent's Marital Status | Single parent | 27 (12.8) |
| | Married | 184 (87.2) |
| Household Size | < 5 members | 60 (28.4) |
| | ≥ 5 members | 151 (71.6) |
| Household Income (RM) | < RM 1000 | 159 (75.4) |
| | RM 1000 – RM 2000 | 41 (19.4) |
| | > RM 2000 | 11 (5.2) |
| Sub -Tribe | Temuan | 194 (91.9) |
| | Semelai | 12 (5.7) |
| | Jakun | 5 (2.4) |
| Parental Educational Level | Primary | 102 (48.3) |
| | Secondary | 99 (46.9) |
| | Tertiary | 10 (4.7) |

*Parental Nutrition Behavior*

Most parents (84.8%, n = 179) were not aware of high-calorie diets, but 81% (n = 171) of them had received information about healthy lifestyles. A majority (93.6%; n = 160) of them obtained information from television and radio, 42.1% (n = 72) from magazines and 65.5% (n = 112) from the internet. A higher proportion of the parents have reported consuming unhealthy foods at least once a week; 57.3% (n = 121) eat sweet snacks, 53.1% (n = 112) consume junk fruit, 66.4% (n = 140) drink soft or energy beverages, 50.2% (n = 106) have chocolate, 70.1% (n = 148) have an intake of sauce, and 54% (n = 114) have candy. About 16.1% (n = 34) of the parents were physically active every day, and most (85.3%, n = 180) exercise less than 60 minutes. On the healthier side, the proportion of parents who consumed vegetables (65.9%, n = 139) was higher than the parents who consumed fruits (18.5%, n = 39) every day, as shown in Table 2.

***Table 2:*** *Distribution of Parental Nutrition Behavior Characteristics*

| **Variables** | **n (%)** |
|---|---|
| **High Calorie Diet Awareness** | |
| Yes | 32 (15.2) |
| No | 179 (84.8) |
| **Received Information About Healthy Lifestyle** | |
| Yes | 171 (81) |
| No | 40 (19) |
| **Source of information about healthy lifestyle (n=171)** | |
| **Magazine** | |
| Yes | 72 (42.1) |
| No | 99 (57.9) |
| **Television and Radio** | |
| Yes | 160 (93.6) |
| No | 11 (6.4) |
| **Internet** | |
| Yes | 112 (65.5) |
| No | 59 (34.5) |
| **Unhealthy Food Consumption** | |
| **Sweet Snack** | |
| Yes | 121 (57.3) |
| No | 74 (35.1) |
| Not sure | 16 (7.6) |
| **Junk Fruits** | |
| Yes | 112 (53.1) |
| No | 77 (36.5) |
| Not sure | 22 (10.4) |
| **Soft or Energy Drink** | |
| Yes | 140 (66.4) |
| No | 49 (23.2) |
| Not sure | 22 (10.4) |
| **Chocolate** | |
| Yes | 106 (50.2) |
| No | 91 (43.1) |
| Not sure | 14 (6.6) |

| | |
|---|---|
| **Sauce** | |
| Yes | 148 (70.1) |
| No | 43 (20.4) |
| Not sure | 20 (9.5) |
| **Candy** | |
| Yes | 114 (54.0) |
| No | 78 (37.0) |
| Not sure | 19 (9.0) |
| **Physical Activities** | |
| Everyday | 34 (16.1) |
| 4-6 days a week | 26 (12.3) |
| 1-3 days a week | 39 (18.5) |
| Sometimes | 72 (34.1) |
| Never | 40 (19.0) |
| **Duration (Minutes)** | |
| < 60 | 180 (85.3) |
| 60 – 120 | 29 (13.7) |
| > 120 | 2 (0.9) |
| **Fruits Consumption** | |
| Everyday | 39 (18.5) |
| 4-6 days in a week | 49 (23.2) |
| 1-3 days in a week | 113 (53.6) |
| Never in a week | 10 (4.7) |
| **Vegetables Consumption** | |
| Everyday | 139 (65.9) |
| 4-6 days in a week | 30 (14.2) |
| 1-3 days in a week | 42 (19.9) |
| Never in a week | 0 (0) |

*n = frequency; % = percentage*

*Indigenous Children's Food Habits and Physical Activity*

The number of students in this study for each variable was recorded in Table 3. It showed that 22.3% (n = 47) consumed fruits and 41.2% (n = 87) ate vegetables every day. Besides, minority children consume unhealthy foods every day. Only 11.4% (n = 24) eat candy, 12.8% (n = 27) drink soft beverages, and 6.6% (n = 14) eat fast food every day. Additionally, there were 10% (n = 21) of the children who never consumed any unhealthy foods.

***Table 3**: Distribution of Children's Food Habits*

| Variables | Every day, n (%) | 4-6 days in a week, n (%) | 1-3 days in a week, n (%) | Never in a week, n (%) |
|---|---|---|---|---|
| Fruits consumption | 47 (22.3) | 49 (23.2) | 109 (51.7) | 6 (2.8) |
| Vegetables consumption | 87 (41.2) | 29 (13.7) | 80 (37.9) | 15 (7.1) |
| Unhealthy foods consumption: Candy | 24 (11.4) | 30 (14.2) | 136 (64.5) | 21 (10.0) |
| Soft drink | 27 (12.8) | 36 (17.1) | 127 (60.2) | 21 (10.0) |
| Fast food | 14 (6.6) | 38 (18.0) | 138 (65.4) | 21 (10.0) |

Table 4 shows the distribution of weekly physical activity among the children. Moderate-level physical activities such as walking to school (34.1%; n = 72) and doing housework (38.4%; n = 81) were the most common physical activities practiced daily. For vigorous-level physical activities, the result indicated that the children were more active in fast cycling (19.9%; n = 42) and sports (19.4%; n = 41) than other activities. Watching television and doing homework were considered sedentary-level activities with a prevalence rate of 74.4% (n = 157) and 57.3% (n = 121), respectively. Hence, watching television appeared as the most common sedentary activity among children.

Furthermore, children who played in the playground have the highest mean of duration (38.44±55.47), while walking to school has the lowest mean of duration (4.88±6.21), as shown in Table 4. Generally, children spend 42 minutes in sports and 30 minutes fast cycling. Watching television was considered the most time spent, which consists of 92 minutes among all physical activities. Nevertheless, most

children did not participate in martial arts, public transport, or cars to school, watching mobile phones, and playing musical instruments.

***Table 4:*** *Distribution of Children's Physical Activity (Weekly)*

| Types of physical activity | Everyday | 4-6 days | 1-3 days | 0 days | Minutes per day |
|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) | Mean ± SD |
| Moderate level Walking to school | 72 (34.1) | 27 (12.8) | 8 (3.8) | 104 (49.3) | 4.88 ± 6.21 |
| Playing in the playground | 42 (19.9) | 11 (5.2) | 46 (21.8) | 112 (53.1) | 38.44 ±55.47 |
| Dancing | 21 (10.0) | 11 (5.2) | 54 (25.6) | 125 (59.2) | 15.31±23.46 |
| Housework | 81 (38.4) | 32 (15.2) | 70 (33.2) | 28 (13.3) | 18.77 ± 19.58 |
| **Vigorous Level** | | | | | |
| Sports | 41 (19.4) | 25 (11.8) | 102 (48.3) | 43 (20.4) | 42.44 ± 42.60 |
| Fast cycling | 42 (19.9) | 17 (8.1) | 50 (23.7) | 102 (48.3) | 30.14 ± 39.18 |
| Skipping rope | 29 (13.7) | 17 (8.1) | 65 (30.8) | 100 (47.4) | 12.76 ± 16.10 |
| Martial Arts | 6 (2.8) | 4 (1.9) | 9 (4.3) | 192 (91.0) | 3.58 ± 13.21 |
| **Sedentary Level** | | | | | |
| Watching television | 157 (74.4) | 8 (3.8) | 29 (13.7) | 17 (8.1) | 92.00 ± 70.45 |
| Doing homework | 121 (57.3) | 37 (17.5) | 48 (22.7) | 5 (2.4) | 57.02 ± 40.35 |
| Public transport/car to school | 43 (20.4) | 18 (8.5) | 9 (4.3) | 141 (66.8) | 3.71± 10.04 |
| Watching mobile phone | 9 (4.3) | 8 (3.8) | 20 (9.5) | 174 (82.5) | 5.43 ± 14.79 |
| Reading book | 71 (33.6) | 47 (22.3) | 81 (38.4) | 12 (5.7) | 40.33 ± 42.23 |
| Playing musical instrument | 6 (2.8) | 6 (2.8) | 28 (13.3) | 171 (81) | 5.45 ±13.74 |

*Correlation between Parents' Healthy Nutrition Behavior with Children's Healthy Food Habits, Vegetable and Fruits Consumption, and Physical Activity*

Parents' healthy nutrition behaviour showed a statistically significant positive correlation with children's healthy food habits (r=0.290, $p$<0.001), including vegetable (r=0.287, $p$<0.001) and fruit consumption (r=0.157, $p$<0.05), as well as their physical activity (r=0.242, $p$<0.001), as shown in Table 5.

***Table 5:*** *Pearson Correlation analysis between Parental Nutrition Behavior and Children's Food Habits and Physical Activity*

| | Healthy food habits | Unhealthy Food habits | Vegetables consumption | Fruits consumption | Physical activity | Sedentary activity |
|---|---|---|---|---|---|---|
| Healthy | 0.290 | 0.131 | 0.287 | 0.157 | 0.242 | 0.030 |
| Nutrition Behavior | ($p$<0.001) | (0.058) | ($p$<0.001) | (0.023) | ($p$<0.001) | (0.668) |
| Unhealthy | 0.177 | 0.108 | 0.168 | 0.093 | 0.222 | 0.087 |
| Nutrition Behavior | (0.010) | (0.117) | (0.015) | (0.178) | (0.001) | (0.209) |
| Vegetables | 0.374 | 0.053 | 0.403 | 0.207 | 0.214 | -0.003 |
| Consumption | ($p$<0.001) | (0.440) | ($p$<0.001) | (0.003) | (0.002) | (0.969) |
| Fruits | 0.431 | -0.121 | 0.178 | 0.585 | 0.138 | -0.064 |
| Consumption | ($p$<0.001) | (0.079) | (0.009) | ($p$<0.001) | (0.046) | (0.354) |
| Physical Activity | 0.058 (0.406) | 0.101 (0.145) | 0.098 (0.154) | -0.022 (0.749) | 0.140 (0.042) | 0.052 (0.454) |

*Bold Numerals are Statistically Significant Values*

Correlation between Parents' Unhealthy Nutrition Behavior with Children's Healthy Food Habits, Vegetable and Fruits Consumption, and Physical Activity

The parents' unhealthy nutrition behaviour showed a statistically significant positive correlation with the children's healthy food habits (r=0.177, p =0.010) including vegetable consumption (r=0.168, p =0.015).

Correlation of Parents' Vegetables and Fruits Consumption with Children's Food Habits, Vegetable and Fruits Consumption, and Physical Activity

Vegetable consumption by the parents showed a positive and significant correlation with the children's healthy food habits (r=0.374, $p$<0.001), including vegetable (r=0.403, $p$<0.001) and fruit (r=0.207, p =0.003) consumption, as well as the children's physical activity (r=0.214, $p$ = 0.002). Besides, the

parents' fruit consumption was significantly correlated with the children's healthy food habits (r=0.431, *p*<0.001), vegetable consumption (r=0.178, p = 0.009), fruit consumption (r=0.585, *p*<0.001) and physical activity (r=0.138, p = 0.046). It indicated that the higher the parents' vegetable and fruit consumption, the higher the children's healthy food habits in terms of vegetable and fruit consumption and also the children's physical activity.

*Correlation of Parents' Physical Activity with Children's Physical Activity*

The parents' physical activity was significantly correlated with the children's physical activity (r=0.140, p =0.042).

*Correlation Between Parental Nutrition Behavior and Children's Food Habits and Physical Activity adjusted for Confounding Variable using Partial Correlation Analysis*

The sociodemographic factors regarding the correlation between two variables were reported in Table 6. There was a statistically significant relationship between the parents' healthy nutrition behaviour and children's healthy food habits (r= 0.289, *p*<0.001), including vegetable (r= 0.288, *p*<0.001) and fruit consumption (r= 0.154, p = 0.025), as well as physical activity (r= 0.244, *p*<0.001), while controlling employment status, as shown in Table 6. On the other hand, the parents' physical activity was related to the children's physical activity while controlling employment status (r=0.139, *p* =0.044), as shown in Table 6.

***Table 6:*** *Partial Correlation analysis between Parental Nutrition Behavior and Children's Food Habits and Physical Activity*

| **Socio-demographics** | **Parental Nutritional behavior** | **Children's Food Habits and Physical Activity** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Healthy food habits** | **Unhealthy Food habits** | **Vegetables consumption** | **Fruits consumption** | **Physically active** | **Sedentary activity** |
| Employment status | Healthy nutrition behavior | 0.289 (*p*<0.001) | 0.133 (0.055) | 0.288 (*p*<0.001) | 0.154 (0.025) | 0.244 (*p*<0.001) | 0.022 (0.753) |
| Marital status | Unhealthy nutrition behavior | 0.190 (0.006) | 0.105 (0.131) | 0.183 (0.008) | 0.100 (0.148) | 0.208 (0.002) | 0.085 (0.222) |
| Relation | Vegetables consumption | 0.369 (*p*<0.001) | 0.077 (0.268) | 0.404 (*p*<0.001) | 0.193 (0.005) | 0.202 (0.003) | 0.033 (0.635) |
| Employment Status | Fruits Consumption | 0.431 (*p*<0.001) | -0.120 (0.083) | 0179 (0.009) | 0.584 (*p*<0.001) | 0.140 (0.043) | -0.072 0.296 |
| Marital status and Employment status | Physical activity | 0.058 (0.401) | 0.100 (0.147) | 0.099 (0.154) | -0.021 (0.758) | 0.139 (0.044) | 0.054 (0.438) |

*Bold Numerals Are Statistically Significant Values*

A positive correlation has been observed between the parents' unhealthy nutrition behaviour and the children's healthy food habits (r= 0.190, *p* =0.006), including vegetables (r= 0.183, *p* =0.008) and physical activity (r= 0.208, *p* =0.002), while controlling marital status as shown in Table 6. Marital status also can control the relationship between the parents' and children's physical activity (r=0.139, *p* =0.044). Children of married parents were more active, as their parents brought them to do physical activity together. Even though one of the parents does not have time to spend with children, another partner is able to accompany them.

A significant correlation was found in vegetable consumption with the children's healthy food habits (r=0.369, *p*<0.001), vegetables (r=0.404, *p*<0.001) and fruit consumption (r=0.193, *p* =0.005), as well as physical activity (r=0.202, *p* =0.003), while relation acts as a control factor as shown in Table 6. Relatives such as uncles or aunties normally do not stay in the same house as the child.

Overall, the statistically significant correlations observed in this study were low to moderate and consistent with effect sizes that are comparable in behavioural and population-based research.

Additionally, the outcomes demonstrated that parental nutrition behaviour and physical activity are classified as key modifiable factors that have an impact on the indigenous children's dietary habits and level of physical activity. While positive parental practices were consistently associated with higher consumption of fruits and vegetables among the children, after controlling for sociodemographic factors. This indicated that parents play a critical role for behavioural change within the indigenous households and highlighted that family-and community-based interventions may improve the child health behaviours in resource-limited indigenous settings.

## Discussion

In the early years of life, children gain nutrition knowledge and food habits that may underpin lifelong eating habits. During childhood, parents choose what a child eats, continuously moulding the child's eating behaviour (Karademir-Hazır, 2021). Certain food nurturing practices, for example, controlling the accessibility of healthy or unhealthy foods and parental eating behaviour are consistently associated with a child's nutritional behaviour, which is shaped within the home environment (Mahmood *et al*., 2021). Hence, healthy parental nutrition behaviour is essential, as it is positively associated with the children's healthy food habits, including vegetable and fruit consumption (De Cianni *et al*., 2023). Nevertheless, as this study is cross-sectional, these findings were interpreted as associations rather than causal effects.

Parents who received healthy lifestyle information from different sources such as magazines, television, radio, and the internet gained nutritional knowledge. According to Saah *et al*. (2021), better recognition of healthy and unhealthy foods was more likely to occur among parents with better nutritional knowledge (Saah *et al*., 2021). Therefore, they tend to focus on teaching their children about the importance of healthy food habits to make them eat healthier foods such as vegetables and fruits. Conversely, children with parents that have low awareness of nutrition were associated with an increased consumption of sweetened beverages such as soft drinks, candies, and unhealthier foods on a regular weekly basis (Sylvetsky *et al*., 2020).

Additionally, parents' healthy nutrition behaviours were positively correlated with the children's physical activities. This was in line with previous research that parents who maintain a healthy lifestyle act as support and encouragement for their children's active lifestyle (Crone *et al*., 2021; Karmali *et al*., 2020). Studies support that health-conscious parents may give more parental care and encouragement to support physical activeness (Bonavolontà *et al*., 2021; Mäkelä *et al*., 2023). For instance, praising the children, watching their participation in physical activity, engaging in parent-child co-activity, transporting them to places where they could be active, and providing them with physical activity equipment (Sohun *et al*., 2021). Parental monitoring increases the children's self-esteem in doing physical activity. In the course of time, they start to develop a healthy lifestyle while being physically active (Cui *et al*., 2024).

Furthermore, unhealthy nutritional behaviour among parents was associated with the children's healthy food habits, including vegetable consumption. Chong *et al*. (2019) reported that indigenous women in Mah Meri, Malaysia, consume fewer vegetables, and this observation could be caused by the limited variety of vegetables around the aborigine settlements (Chong *et al*., 2019). Secondly, the parents could not afford vegetables from the market; however, due to their love towards their children, parents usually foresee their children to be healthy, and thus, they might choose unhealthy nutritional behaviour to promote their children's healthy food habits. In contrast, for the indigenous parents who can afford vegetables, they have more chances to develop their own healthy nutrition behaviour and enhance the children's healthy food habits by increasing their vegetable intake. Current research showed that parental food habits and feeding strategies are the main determinants of a child's eating behaviour and food choices (Ningning & Wenguang, 2023). When the parents include a wide variety of vegetables and fruits in the diet, children may follow this dietary pattern and start to develop healthy food habits, and this persists throughout their life (Mäkelä *et al*., 2023). The observed association demonstrated an exploratory phase that was interpreted cautiously, taking into account the residual confounding and reporting bias.

According to Kovács *et al*. (2024), the frequency of physical activity of parents and children's engagement in sports significantly correlated with the children's desire to conform to their parents' model (Kovács *et al*., 2024). Since parents are primary socialization agents and influential role models, children follow their parents to be physically active through modeling behaviour. Parents who are physically active are more likely to encourage their child's healthy behaviour, including the reinforcement of the benefits of an active lifestyle, thus increasing the likelihood that their children emulate their actions (Petersen *et al*., 2020). According to Grant *et al*. (2020), support behaviours done by parents to increase the activity of children, such as engaging in parent-child co-activity, praising the child that was involved in physical activity, providing activity equipment like skipping rope, watching the child's participation in physical activity and transporting the child to places where the latter could be active (Grant *et al*., 2020).

Additionally, for parents who are employed full-time, such as in government or private jobs, these commitments were associated with reduced time to cook or prepare healthy foods, so it was difficult for them to maintain regular healthy meal patterns (Leu *et al*., 2024). This was in line with a previous study by Mahmood *et al*. (2021), who reported that parents had less control over the food eaten by their children due to longer working hours (Mahmood *et al*., 2021). Therefore, in comparison with the food prepared at home, studies have shown that most outside foods are unhealthy and low in nutritional quality due to the high amounts of salt, sugar, fat, and calories and low amounts of nutrients (Gesteiro *et al*., 2022; Sarkingobir & Miya, 2024; Wellard-Cole *et al*., 2022). Additionally, parents who were having a busy lifestyle may have ignored the importance of being physically active and hence did not provide a supportive environment in the home and was associated with gradual physical inactivity of the children (Walker *et al*., 2022). In comparison with single parents, they may support the whole household income and education of children. Therefore, they may not have extra money to purchase healthy foods (Ravikumar *et al*., 2022). Hence, this leads to unhealthy parental nutrition behaviour as it is a tough task for single parents to monitor and encourage their children.

Moreover, parents must offer their children different kinds of healthy foods to increase their exposure. If they dislike the food, parents can repeat the exposure of those foods to stimulate their taste. This is a useful strategy for children to accept different types of food and develop healthy food habits. For instance, the indigenous population should be offered gamified educational programs to teach them about healthy eating and staying active (Kim *et al*., 2025). Through these types of programs, all the indigenous children from different socioeconomic levels could learn about the information and benefits of physical activity and healthy foods, while parents can increase their awareness of the nutritional status of their children and receive advice on maintaining their long-term healthy nutrition behaviours. In addition, to develop strategies that increase access to nutritious food, food subsidy programs or meal provision ought to be considered for families experiencing unstable income. Meanwhile, the financial barriers to accessing healthy foods can be reduced through a healthy foods discount program.

*Limitations and Future Scope of Research*

Undeniably, the strength of this study is that the data was collected from a diverse, large, and population-based sample. The generalisation of the findings is ensured through the data collected, such as ethnicity, gender, age, and socioeconomic diversity of the study sample. Additionally, since most of the previous research on the influences of parents on children's food habits and physical activity has focused on the self-reports of the mothers solely, the data collected in this study were obtained from the mothers, fathers, grandparents, uncles, or aunties.

However, there is one limitation occurring in the study that offers a starting point for future research. For the study participant, they were not asked about the barriers that develop healthy nutrition behaviour and physical activeness as a parent. Hence, the barriers may not be fully understood by others due to little information and require further research.

## Conclusion

This study highlighted the significant influence of parental nutrition behaviour on indigenous children's food habits and physical activity. Specifically, parents' characteristics appeared to generate positive spillover effects, which support the children's good nutritional status through healthy food habits and increased physical activity. The strength of parental modelling was not only demonstrated but also how contextual factors influence the transfer of healthy behaviours. It offers novel insights that can be used to guide culturally appropriate interventions for indigenous families.

## Conflict of Interest

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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