Assessing Dietary and Physical Activity Patterns During Pregnancy Among Antenatal Mothers in Sri Lanka: A Cross-Sectional Study at a Selected Medical Officer of Health Clinic

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Abstract: This study assessed 240 antenatal mothers in Sri Lanka's Kebithigollawa Medical Officer of Health Clinic. Demographics varied, revealing distinct marital statuses, ethnicities, income levels, and employment statuses. Pregnancy stages, parity, pre-pregnancy BMI, and gestational age exhibited diverse profiles. Hemoglobin levels ranged, reflecting nutritional status, while BMI indicated varied weight categories. Dietary patterns demonstrated associations with maternal health indicators; fruits, vegetables, meat, fish, unsweetened dairy products, prepared food, and rice/noodles positively correlated with hemoglobin levels, BMI, and gestational weight gain. Conversely, some dietary choices displayed weaker correlations. These findings emphasize the need for tailored interventions to enhance antenatal mothers' dietary and physical activity behaviors, benefiting maternal and child health.

Keywords: antenatal mothers; dietary habits; maternal health indicators

1. Introduction

There are several social, psychological, behavioral, and biological changes that occur during pregnancy (Gaston & Cramp, 2011). The health behaviors a woman adopts while pregnant carry lifelong consequences for her own well-being and the long-term health of her child (Cilar Budler & Budler, 2022). Encouraging a balanced diet and regular physical activity throughout pregnancy can facilitate optimal weight gain(Morris *et al.*, 2020), thereby reducing the likelihood of unfavorable consequences such as obesity, excessive gestational weight gain, gestational diabetes, pre-eclampsia, and heightened susceptibility to type 2 diabetes; moreover, it can help mitigate the probability of offspring developing childhood overweight, obesity, and eventual onset of type 2 diabetes in adulthood (Catalano *et al.*, 2009; Clausen *et al.*, 2008). Although maintaining a healthy lifestyle during pregnancy is crucial, many women fail to meet recommended dietary and physical activity guidelines, and while numerous interventions have been created to address this issue, the outcomes of trials frequently demonstrate insignificant, limited, or transient effects (Goldstein *et al.*, 2017; Morris *et al.*, 2020). Moreover, in the Anuradhapura district, a study conducted by (Weerakoon, 2015) reported an annual average of approximately 15,000 births between 2010 and 2015. During this timeframe, several notable trends emerged, including an increase in the prevalence of low birth weight infants, a rise in home deliveries, and a decline in stillbirth rates. Additionally, there was a decrease in teenage pregnancy rates, whereas the rates of lower-segment cesarean sections and antenatal morbidity increased. Maternal body mass index rates decreased, and maternal mortality rates

exhibited fluctuation. Family planning method usage displayed fluctuations as well, marked by increased utilization of oral contraceptive pills, intrauterine devices, and implants, accompanied by reduced unmet needs. It is important to highlight that there has been minimal research conducted on antenatal healthcare during and after this period. Therefore, this study aimed to assess the diet, physical activity, and associated factors during pregnancy among antenatal mothers at the Kebithigollawa Medical Officer of Health Clinic in Sri Lanka.

2. Methods

A descriptive cross-sectional design was employed to assess the relationship between pregnancy and factors encompassing diet, lifestyle, and physical activity. Ethical approval was secured from the Ethics Review Committee of KIU, and permission was granted by the 'Kebithigollawa' Medical Officer of Health Clinic in Sri Lanka. In the study, only volunteer participants were involved, and they were given the freedom to withdraw from the study at any time without being required to provide a reason. Pregnant mothers who were registered at 'Kebithigollawa' Medical Officer of Health Clinic in Sri Lanka were included, while pregnant mothers with medical or obstetric contraindications for exercise during pregnancy, multiple pregnancies, complicated pregnancies, and those subject to special diets or dietary restrictions were excluded. Furthermore, the pretest was conducted by enrolling 10 pregnant mothers registered at 'Kebithigollawa' Medical Officer of Health Clinic in Sri Lanka, who were subsequently excluded from the sample, and the prepared questionnaire was adjusted according to the feedback received. `The sample size of 224 was calculated using the following established formula explained by (Daniel, 1999; Naing *et al.*, 2006).

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

where *n* = sample size,

Z = Z statistic for a level of confidence,

P = expected prevalence or proportion (in proportion of one; if 20%, *P* = 0.2), and

d = precision (in proportion of one; if 5%, *d* = 0.05).

An interviewer-administered questionnaire, conducted through the pencil-paper method (Iordachescu *et al.*, 2020), was used to cover socio-demographics, pregnancy details, dietary habits, and physical activity (measured using the International Physical Activity Questionnaire) (Harrison *et al.*, 2011). Data analysis was performed using the SPSS 25.0 version, and ethical considerations were rigorously adhered to throughout the research process.

3. Results

The demographic characteristics of antenatal mothers at the 'Kebithigollawa' Medical Officer of Health Clinic, Anuradhapura district in Sri Lanka, were displayed in Table 1, revealing a diverse range of profiles. Among 224 participants, the majority, constituting 68.75% (n=154) of the mothers, fell within the age range of 25 to 34 years. Other age ranges were prevalent, each accounting for 15.63% (n=35) of the total. When considering marital status, most of the antenatal women were married, comprising 87.95% (n=197), while others had to manage their healthcare without the support of a spouse. The education status results indicated that only 2.23% (n=5) could be considered illiterate, making the rest more easily amenable to maternal self-care education. The antenatal women represented three major ethnicities of Sri Lanka, namely Sinhala, Tamil, and Muslims, with the majority belonging to Sinhala ethnicity, accounting for 74.11% (n=166). When considering the

economic status of antenatal women, 41.52% (n=93) were unemployed during their maternal period, and approximately 67.86% (n=152) were earning less than 50,000 LKR, indicating their low-income status.

Table 1. Socio-Demographic Characteristics of Study Participants

Socio-demographic variables	Category	Frequency
Age(years)	Below 25	35
	25-34	154
	Above 35	35
Marital status	Married	197
	Single	8
	Divorced	11
	Widowed	8
Education level	No Schooling	5
	Primary Education	20
	Primary Education	96
	Tertiary Education	103
	Higher Education	0
Monthly income Level (LKR)	<10 000	18
	10 000 –50 000	134
	>50 000	72
Ethnicity	Sinhalese	166
	Tamil	9
	Muslim	49
Employment status during pregnancy	Employed	93
	Unemployed	131

Table 2. Maternal Health Profile of Study Participants.

Maternal Health Profile	Category	Frequency
Trimester	First	47
	Second	97
	Third	80
Parity	0	102
	1	57
	2	34
	>3	31
Pre-Pregnancy BMI (kg/m2)	<25.0	107
	25.0–29.9	71
	>30.0	46
Gestational Age(months)	(1-3)	42
	(4-6)	102
	(7-9)	80
Hemoglobin (g/dl)	< 8	6
	8 -9.9	44
	10 –10.9	79
	> 11	95
Pregnancy BMI (kg/m2)	<18.5	27

18.5-24.9	70
25 –29.9	87
> 30	40

The pregnancy-related data are presented in Table 2. It reveals that out of the total sample size of 224, 21% (n=47) of antenatal mothers attended the clinic during their first trimester, while the majority, comprising 43% (n=97), were in their second trimester. Additionally, 36% (n=80) of antenatal mothers were in their third trimester. When considering the duration of pregnancy before birth based on historical data and neonatal examinations, the majority, 81% (n=182), exceeded three months. Furthermore, 45.5% (n=102) of the antenatal mothers had no previous viable pregnancies, classifying them as nulliparous, while 25.4% (n=57) had one previous viable pregnancy, indicating primiparity. In addition, 15.2% (n=34) of the antenatal mothers had two previous viable pregnancies, making them multiparous with two pregnancies, and 13.8% (n=31) had more than three previous viable pregnancies, categorizing them as multiparous with three or more pregnancies. Regarding pre-pregnancy BMI, 48% (n=107) had a BMI below 25.0 kg/m², signifying normalcy, while 32% (n=71) had a BMI between 25.0 and 29.9 kg/m², indicative of overweight. Furthermore, 20% (n=46) had a pre-pregnancy BMI greater than 30.0 kg/m², classifying them as obese. Hemoglobin levels showed 3% (n=6) with levels less than 8 g/dL, indicating anemia, while 20% (n=44) fell between 8 and 9.9 g/dL, signifying mild anemia. Additionally, 35% (n=79) had levels between 10 and 10.9 g/dL, considered within the normal range for non-pregnant women, albeit slightly lower during pregnancy, and 42% (n=95) had levels greater than 11 g/dL, signifying a normal and healthy hemoglobin level during pregnancy. In terms of current BMI, 12% (n=27) were below 18.5 kg/m², indicating underweight, while 31% (n=70) fell between 18.5 and 24.9 kg/m², within the normal weight range. Moreover, 39% (n=87) had a current BMI between 25 and 29.9 kg/m², classifying them as overweight, and 18% (n=40) had a current BMI greater than 30 kg/m², categorizing them as obese.

Diverse dietary patterns were observed in the study as mentioned in Table 3, with the most common consumption pattern for unsweetened milk products noted in 37% of respondents, who reported no consumption, while 63% consumed (1-5) portions per day. Sweetened beverages were consumed by 71% of participants, with intake ranging from (1-5) portions per day. A majority of participants, constituting 87%, consumed (1-5) portions of whole grain bread daily. Likewise, 81% of participants consumed (1-5) portions of white bread daily. When assessing weekly consumption, meat and fish intake favored (1-5) portions per week (84%), while ready-made meals (93%) and fried potatoes (94%) were consumed in the range of (1-7) portions per week. Potatoes were also consumed by 94% of participants, with intake falling within (1-5) portions per week, and rice/noodles found popularity at (1-7) portions per week (86%). These findings offer a comprehensive insight into the dietary and health profiles of the antenatal mothers in the study, laying the foundation for further analysis of their nutritional requirements and potential interventions.

In the assessment of physical activity engagement among pregnant women during a trimester, as detailed in Table 3, a substantial duration was allocated to diverse activities, with the findings revealing a notable percentage of expectant mothers participating in these activities. Regarding food preparation, it is noteworthy that 33% of the participants allocated 1 to almost 2 hours daily to this activity, suggesting that a minimum of 76% of pregnant women were actively engaged in cooking and related tasks for a minimum of half an hour. Significant involvement in caregiving tasks while sitting was indicated by a substantial percentage (57%) of antenatal women, with 77% also participating in these activities while standing, dedicating half to nearly 3 hours per day to tasks such as dressing, bathing, and feeding children. Active participation in childcare activities, including

playing with children while either sitting or standing, was reported by 77% of antenatal women, with 75% engaging in such activities while walking or running, for durations spanning from under half an hour to 3 hours. Work-related activities revealed that in work or class settings, 67% of participants spent less than half an hour to 2 hours per day sitting at work or in class. In the context of watching TV or videos, a substantial majority, accounting for 96% of participants, spent less than half an hour to 3 hours per day watching TV or videos, with no one dedicating more than 3 hours. Concurrently, activities encompassing arranging beds, doing laundry, ironing, and tidying up occupied the time of 93% of respondents for durations ranging from under half an hour to 3 hours per day. Concerning heavier cleaning activities encompassing tasks like vacuuming, mopping, sweeping, and washing windows, 83% of participants reported their engagement, with daily durations spanning from less than half an hour to 2 hours. Shopping activities, which included purchasing groceries, clothing, and various items, were undertaken by 89% of the study's participants, with daily time allocations ranging from less than half an hour to 2 hours. Daily activities involving walking, standing, and carrying objects were common among participants, with 85% engaging in slow walking for durations ranging from under half an hour to 2 hours per day, 79% spending less than half an hour to 3 hours per day on standing or slow walking while carrying items, and another 79% allocating similar durations to standing or slow walking at work without carrying anything. The research demonstrated that a majority of expectant mothers engaged in walking quickly to various destinations, allocating between half an hour to 3 hours per day, while a minority of 32% did not participate in such activities. Additionally, among those who were employed, 87% spent between half an hour to 3 hours per day walking quickly while carrying items, and 82% dedicated a similar time frame to quick walking at work when not carrying anything. The study indicated that the majority of participants (64%) did not engage in any form of exercise, with only a quarter (25%) reporting participation in exercise for half to 1 hour per day; similarly, while 75% of participants did not jog, 13% were involved in jogging exercises for a duration of half to 1 hour. These findings offer a comprehensive overview of the physical activities undertaken by antenatal women during the specified trimester, highlighting the varying levels of involvement in different tasks.

Table 3. The Details of Dietary Patterns and Physical Activities of Antenatal Mothers.

Consumption per day	Maximum percentage of food portions (%)					
	0	1	(2-3)	(4-5)	(6-7)	> 7
Fruits/vegetables	0	18	32	26	10	14
Unsweetened milk products	37	32	22	9	0	0
Sweetened beverages	24	30	25	16	3	2
Wholegrain bread	8	34	41	12	5	0
White bread	17	31	35	15	2	0
Consumption per week						
Meat and fish	6	21	44	19	6	4
Ready-made meals	1	27	43	23	6	0
Fried potatoes	3	37	29	8	20	3
Potatoes	8	37	39	13	0	3
Rice/noodles	8	13	40	23	10	6
Involvement of physical activities by the pregnant mothers(%)						
	None	<1/2	(1/2)-1	(1-2)	(2-3)	>3
Preparing meals /hours per day	5	19	21	33	17	5

Dressing, bathing, and feeding children while sitting/hours per day	14	24	32	20	5	5
Dressing, bathing, and feeding children while standing/hours per day	2	21	30	35	12	0
Playing with children while sitting or standing/hours per day	23	20	33	15	9	0
Playing with children while walking or running/hours per day	25	25	33	15	2	0
Watching TV or a video/hours per day	4	18	23	33	22	0
Light cleaning (make beds, laundry, iron, put things away)/hours per day	5	18	35	40	2	0
Shopping (for food, clothes or other items)/hours per day	6	34	47	18	5	0
Heavier cleaning (vacuum, mop, sweep, wash windows)/hours per day	17	25	34	19	5	0
Walking slowly to go places (such as to the bus, work visiting)/hours per day	8	39	32	14	7	0
Walking quickly to go places (such as to the bus, work, or school)/hours per day	32	40	16	12	0	0
Exercises/hours per day	64	8	25	3	0	0
Jogging/hours per day	75	12	13	0	0	0
Sitting at work or in class/hours per day	30	11	16	19	21	3
Standing or slowly walking at work while carrying things/hours per day	18	31	30	14	4	3
Standing or slowly walking at work while not carrying anything/hours per day	18	32	29	14	4	3
Walking quickly at work while carrying things/hours per day	13	31	35	10	11	0
Walking quickly at work while not carrying anything/hours per day	18	26	30	15	11	0

The investigation into the effects of dietary habits during pregnancy uncovered noteworthy correlations, supported by specific values, shedding light on their impact on various health indicators. Notably, a positive and statistically significant correlation was found between the consumption of fruits and vegetables (r = 0.55), meat (r = 0.54), fish (r = 0.64), unsweetened dairy products (r = 0.57), and prepared food (r = 0.57) with hemoglobin levels, indicating the crucial role of these dietary components in maintaining healthy hemoglobin levels. Likewise, these dietary choices exhibited positive and significant correlations with BMI, with meat (r = 0.707), fish (r = 0.679), prepared food (r = 0.795), unsweetened dairy products (r = 0.517), and rice/noodles (r = 0.599) demonstrating their influence on maternal weight status during pregnancy. Furthermore, the consumption of sweet drinks (r = 0.194), fried potatoes (r = 0.44), and certain types of bread (r = 0.274) displayed weaker positive correlations with both hemoglobin levels and BMI, suggesting a less pronounced but still relevant impact. Additionally, positive, and significant correlations were observed between the intake of fruits and vegetables (r = 0.66), meat (r = 0.76), fish (r = 0.538), prepared food (r = 0.69), rice/noodles (r = 0.56), and unsweetened dairy products (r = 0.66) with gestational weight gain, emphasizing the substantial role of these dietary components in shaping maternal weight during pregnancy. Conversely, fried potatoes (r = 0.30), sweet drinks (r = 0.194), and certain types of bread (r = 0.34) displayed weaker positive correlations with gestational weight gain, providing a comprehensive understanding of the complex relationship between dietary choices and maternal health indicators during pregnancy, which can inform targeted nutritional interventions.

The investigation into the impact of physical activity during pregnancy unveiled intriguing correlations between specific activities and maternal health indicators. In relation to BMI, the data showed varying correlations, with activities such as watching TV or a video (r = 0.41), light cleaning (r = 0.31), and exercises (r = 0.27) demonstrating positive associations, suggesting that engagement in these activities tended to be associated with higher BMI levels during pregnancy. Conversely, activities like heavier cleaning (vacuuming, mopping, sweeping, and washing windows) exhibited a negative correlation (r = -0.31), indicating a potential link between such tasks and lower BMI levels. Moreover, the correlation between physical activities and gestational weight gain revealed distinct patterns, with watching TV or a video (r = 0.78), light cleaning (r = 0.45), and exercises (r = 0.39) displaying positive associations, indicating that participation in these activities may contribute to greater weight gain during pregnancy. In contrast, heavier cleaning displayed a negative correlation (r = -0.22), suggesting a potential role in limiting gestational weight gain. These findings underscore the intricate relationship between specific physical activities and maternal health indicators, providing valuable insights for tailored recommendations and interventions during pregnancy.

4. Conclusion

During this investigation involving antenatal mothers in Sri Lanka, a diverse array of demographic profiles and pregnancy experiences within this cohort has been revealed. Significant correlations have emerged between specific dietary components, physical activities, and critical maternal health indicators, illuminating the intricate interplay of lifestyle factors during pregnancy. These findings underscore the imperative need for tailored interventions and educational initiatives to enhance dietary and physical activity behaviors among antenatal mothers, potentially mitigating adverse health outcomes and contributing to the long-term well-being of both mothers and their offspring.

References

1. Catalano, P. M., Farrell, K., Thomas, A., Huston-Presley, L., Mencin, P., De Mouzon, S. H., & Amini, S. B. (2009). Perinatal risk factors for childhood obesity and metabolic dysregulation. *American Journal of Clinical Nutrition*, 90(5), 1303–1313. DOI: 10.3945/ajcn.2008.27416
1. Cilar Budler, L., & Budler, M. (2022). Physical activity during pregnancy: a systematic review for the assessment of current evidence with future recommendations. *BMC Sports Science, Medicine and Rehabilitation*, 14(1), 1–14. DOI: 10.1186/s13102-022-00524-z
2. Clausen, T. D., Mathiesen, E. R., Hansen, T., Pedersen, O., Jensen, D. M., Lauenborg, J., & Damm, P. (2008). High prevalence of type 2 diabetes and pre-diabetes in adult offspring of women with gestational diabetes mellitus or type 1 diabetes: The role of intrauterine hyperglycemia. *Diabetes Care*, 31(2), 340–346. DOI: 10.2337/dc07-1596
3. Gaston, A., & Cramp, A. (2011). Exercise during pregnancy: A review of patterns and determinants. *Journal of Science and Medicine in Sport*, 14(4), 299–305. DOI: 10.1016/j.jsams.2011.02.006
4. Goldstein, R. F., Abell, S. K., Ranasinha, S., Misso, M., Boyle, J. A., Black, M. H., Li, N., Hu, G., Corrado, F., Rode, L., Kim, Y. J., Haugen, M., Song, W. O., Kim, M. H., Bogaerts, A., Devlieger, R., Chung, J. H., & Teede, H. J. (2017). Association of gestational weight gain with maternal and infant outcomes: A systematic review and meta-analysis. *JAMA - Journal of the American Medical Association*, 317(21), 2207–2225. DOI: 10.1001/jama.2017.3635
5. Harrison, C. L., Thompson, R. G., Teede, H. J., & Lombard, C. B. (2011). Measuring physical activity during pregnancy. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1), 19. DOI: 10.1186/1479-5868-8-19

6. Iordachescu, A. C., Cirstoiu, M. M., Zugravu, C. A., Teodor, O. M., Turcan, N., Ducu, I., & Bohiltea, R. E. (2020). Dietary behavior during pregnancy. *EXPERIMENTAL AND THERAPEUTIC MEDICINE*, 20, 2460–2464.

7. Morris, T., Strömmer, S., Vogel, C., Harvey, N. C., Cooper, C., Inskip, H., Woods-Townsend, K., Baird, J., Barker, M., & Lawrence, W. (2020). Improving pregnant women's diet and physical activity behaviors: The emergent role of health identity. *BMC Pregnancy and Childbirth*, 20(1), 1–12. DOI: 10.1186/s12884-020-02913-z

8. Naing, L., Winn, T., & Rusli, B. N. (2006). Practical Issues in Calculating the Sample Size for Prevalence Studies. *Archives of Orofacial Sciences*, 1(January), 9–14.

9. Daniel WW (1999). *Biostatistics: A Foundation for Analysis in the Health Sciences*. 7th edition. New York: John Wiley & Sons.

10. Weerakoon, H. (2015). Analysis of maternal and child health (MCH) care status in Anuradhapura District for a 5-year period since 2010 to 2015. *Anuradhapura Medical Journal*, 9(2Supp), 35. DOI: 10.4038/amj.v9i2supp.7584