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Association Between Parity And Bmi In A Suburban Nepalese Community, Dhulikhel

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Abstract

The escalating prevalence of obesity rates in developing countries is posing major public concerns. However, limited research has been conducted in the context of South Asia and Nepal. This study aims to examine the link between parity and BMI in women in a suburban Nepali community, Dhulikhel. This study is a secondary data analysis of the Dhulikhel Heart Study (DHS). The study sample included women aged 18-59 years. BMI was based on measured height and weight. The result shows that prevalence of obesity is very high in women with high parity. Furthermore, the result of the ordinal logistic regression show that higher parity is associated with higher odds of being in a higher BMI category (overweight/obese). The odds were the highest in women who gave birth to 3 children, where the odds were 4.02 (95 CI: 1.85-8.91) times higher compared to women who did not give birth to any. Culturally situated beliefs and postpartum diet habits in Nepal may further explain this relationship.

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Introduction

The global prevalence of obesity has risen dramatically since 1975, with developing countries experiencing a greater increase than developed nations (Carrera-Bastos et al., 2011; NCD Risk Factor Collaboration (NCD-RisC), 2017). Particularly notable is the significant shift in body mass index (BMI) observed in South Asia(NCD Risk Factor Collaboration (NCD-RisC), 2017), where 'westernization' in dietary habits and lifestyles is noted as a driver of weight gain (Blüher, 2019). Nepal is no exception to this trend, as rising rates of obesity and related non-communicable diseases are observed (Subedi et al., 2017). According to the 2016 Nepal Demographic and Health Survey (NDHS), the percentage of overweight or obese women aged between 15-49 increased from 9 percent in 2006 to 22 percent in 2016 (DHS, 2017). While a higher average BMI was observed in urban areas among Nepali women, a much faster increase was observed in rural regions (Subedi et al., 2017).

A limited number of studies have examined the relationship between parity and obesity. In a repeated cross-sectional study using Demographics Health Survey (DHS) data from 33 LMICs, lower parity was shown to be associated with less overweight (Lopez-Arana et al., 2013). A cross-sectional study conducted in 28 countries showed a higher association between parity and overweight among wealthy women, while a shift in the burden of parity-related overweight was observed toward including the poor (Kim et al., 2007). Despite the importance of this relationship in the public health context, research in this area remains relatively scarce, particularly in the context of South Asia. Notably, no prior research has primarily focused on investigating this association in Nepal, which underscores the need for exploration.

This study aims to examine the association between parity and BMI among women in Dhulikhel, a suburban community in Nepal. The results of this study will provide insight into the trends of obesity among women in Nepal and may contribute to the development of public health policies and targeted obesity intervention strategies.

Methods

Data Source and Study Sample

This is a secondary data analysis of the Dhulikhel Heart Study (DHS) (Shrestha et al., 2016), which is a prospective, longitudinal cohort study that evaluated cardiovascular disease (CVD) prevalence and associated risk factors in the town of Dhulikhel, a suburban community in Nepal. The first wave of the DHS was conducted from November 2013 to February 2015, where 1073 participants who were 18 years or older were recruited from a randomly selected sample comprising one-third of the total households in Dhulikhel. Among the 1073 participants, women aged between 18 and 59 were included in this study to examine the association between parity and Body Mass Index (BMI). The study sample was restricted to ages 18-59 at the time of the survey to avoid age 60 years and beyond when aging and related chronic conditions can be associated with weight loss. One participant with missing BMI values was excluded from the study, resulting in a final sample of 534 participants.

Measures

BMI Assessment

Weight and height were measured using standard procedures (Shrestha et al., 2016). Weight was measured using an Omron Model HBF-400 scale to the nearest 0.1 pounds with individuals wearing minimal clothing and no footwear. Height was measured to the nearest 0.1cm using a standard tape measure while the participants stood against a wall. BMI was calculated as weight in kilograms(kg) divided by height in meters squared(m^2). This study utilized the WHO recommended cut-off for the Asia-Pacific region, specifically on adult Asians ((World Health Organization, 2000). The proposed classification is as follows: BMI < 18.5 is underweight, BMI within 18.5-22.9 range is normal, BMI that is ≥23 is overweight, and BMI ≥25 is obese. Considering the relatively small number (n=27) of participants with a BMI value of 18.5 kg/m^2 or less, a classification of 3 groups was used - not overweight/obese group (<23 kg/m^2), overweight group (23 to <25 kg/m^2), and obese group (≥25 kg/m^2).

Parity assessment

Parity is defined in this paper as the number of children a woman has given birth to in her lifetime at the time of data collection. The questionnaire asked women whether they have ever been pregnant, and if so, to report the number of the given birth. In our study, parity was categorized into 5 groups - 0, 1, 2, 3, 4 or more.

Assessment of other variables

In 2013, trained research staff conducted face-to-face interviews using a structured questionnaire on socio-demographic characteristics (age, ethnicity, education, occupation), lifestyle habits (tobacco use, alcohol use, high sugar food consumption, fruit and vegetable consumption), medical history of diabetes, and reproductive history. Hypertension was assessed by three measurements of the participant's blood pressure, taken 5 minutes apart. Individuals were classified to have hypertension if the average of their three systolic blood pressure measurements was ≥ 140mmHg, the average diastolic blood pressure was ≥ 90mmHg, or they were on anti-hypertension medication. Diabetes status was self-reported through a questionnaire that assessed whether participants had ever been diagnosed with diabetes by a doctor. For the assessment of physical activity, the WHO Global Physical Activity Questionnaire (GPAQ) was utilized (Armstrong & Bull, 2006). Based on the responses, physical activity level was calculated in METs, which refers to metabolic equivalent, and 1 MET is the expended energy rate while at rest. (World Health Organization, 2010). A threshold of 600 MET minutes (Bull et al., 2020) was used in the analysis to assess whether individuals met the physical activity requirements.

Statistical analysis

R software version 4.2.2 (R Foundation for Statistical Computing, Vienna, Austria) was used for data analysis. We first described the study population by parity groups (0, 1, 2, 3, 4 or more) using mean (SD) for continuous variables and frequency (percent) for categorical variables. ANOVA tests were used to analyze the relationship between parity groups (0, 1, 2, 3, 4 or more) and continuous variables, and Pearson's chi-square statistics were used for categorical variables.

Ordinal regression analysis was utilized to examine the association between parity and BMI groups. 5 parity groups (0, 1, 2, 3, 4 or more) and 3 BMI(kg/m^2) category groups—not overweight/obese (OOB) (< 23 kg/m^2), overweight(23≤ BMI< 25 kg/m^2), and obese (≥25 kg/m^2) were included in the analysis. The odds ratio of being in a higher BMI category (overweight or obese) for different parity groups was examined. P values $\leq$ 0.05 were considered significant, and all tests were two-tailed.

In our study, our potential covariates were derived from what was available from the dataset, based on the subject-specific knowledge and expertise of our research team. We decided to include all potential confounding variables in our model, instead of selecting the "optimal" model using statistical methods. We made this decision based on the importance of integrating subject-specific background knowledge to minimize the risk of omitting relevant variables, and weakly correlated variables can remain meaningful as it can potentially mitigate the variance of the effect estimates, allowing the model to become more precise and stable (Heinze et al., 2018).

Results

Of the total 534 women aged 18-59 years participating in the Dhulikhel Heart Study in Nepal from 2013 to 2015, 144 (27.0%) had never given birth to a child, while 390 (73.0%) had one or more children.

Table 1. Descriptive characteristics of the study sample by parity

	Parity					
	0 (n=144)	1 (n=76)	2 (n=121)	3 (n=87)	4 + (n=106)	p value†
Age in years (mean ± SD)	24.7 ± 8.85	27.7 ± 8.40	34.8 ± 6.86	44.5 ± 7.23	48.1 ± 6.87	<0.001
Ethnicity						
Brahmin	17 (11.8%)	6 (7.9%)	19 (15.7%)	16 (18.4%)	15 (14.2%)	0.153
Chettri/Thakuri/Sanyasi	15 (10.4%)	13 (17.1%)	21 (17.4%)	15 (17.2%)	12 (11.3%)	
Newar	79 (54.9%)	36 (47.4%)	59 (48.8%)	35 (40.2%)	44 (41.5%)	
Others	33 (22.9%)	21 (27.6%)	22 (18.2%)	21(24.1%)	35 (33.0%)	
Education Level (years)						
No education (0)	13(9%)	9(11.8%)	32(26.4%)	53(60.9%)	77(72.6%)	<0.001
Primary education (1-5)	4(2.8%)	9(11.8%)	22(18.2%)	15(17.2%)	16(15.1%)	
Secondary education (6-12)	73(50.7%)	44(57.9%)	65(53.7%)	18(20.7%)	12(11.3%)	
Higher education (13-17)	54(37.5%)	14(18.4%)	2(1.7%)	1(1.1%)	1(0.9%)	
Occupation						
Employed	40(27.8%)	25(32.9%)	32(26.4%)	19(21.8%)	26(24.5%)	<0.001
Unemployed	20(13.9%)	34(44.7%)	73(60.3%)	56(64.4%)	69(65.1%)	
Student	84(58.3%)	17(22.4%)	16(13.2%)	12(13.8%)	11(10.4%)	
Ever used Tobacco						
Yes	8(5.6%)	4(5.3%)	7(5.8%)	17(19.5%)	40(37.7%)	<0.001
No	136(94.4%)	72(94.7%)	114(94.2%)	70(80.5%)	66(62.3%)	
Ever used Alcohol						
Yes	14(9.7%)	12(15.8%)	16(13.2%)	23(26.4%)	38(35.8%)	<0.001
No	130(90.3%)	64(84.2%)	105(86.8%)	64(73.6%)	68(64.2%)	
Physical Activity						
Met Guideline (400 METs/week)	66(45.8%)	38(50%)	49(40.5%)	41(47.1%)	38(35.8%)	<0.001
Not met guideline	78(54.2%)	38(50%)	72(59.5%)	46(52.9%)	68(64.2%)	
Fruit and Vegetable consumption (portion/week)	57.9 ± 35.0	55.8 ± 36.1	57.6 ± 34.6	51.6 ± 30.8	45.1 ± 29.1	0.021
High-sugar food consumption (portion/week)	6.48 ± 6.24	4.40 ± 3.94	4.55 ± 3.70	3.03 ± 2.36	2.60 ± 2.29	<0.001
Diabetes						

Yes	1(0.7%)	2(2.6%)	2(1.7%)	2(2.3%)	8(7.5%)	0.004
No	141(97.9%)	72(94.7%)	116(95.9%)	81(93.1%)	89(84%)	
Don't know	2(1.4%)	2(2.6%)	3(2.5%)	4(4.6%)	9(8.5%)	
Hypertension						
Yes	10(6.9%)	3(3.9%)	21(17.4%)	20(23%)	21(19.8%)	<0.001
No	134(93.1%)	73(96.1%)	100(82.6%)	67(77%)	85(80.2%)	

Parity is the number of births a woman has given – 0, 1, 2, 3, 4+. Table values are mean ± SD for continuous variables and n (column %) for categorical variables. † P-value is for $\chi2$ test in categorical variables or ANOVA test for continuous variables.

Table 1 lists the characteristics of the women by parity groups of 0, 1, 2, 3, and 4 or more. The mean age is higher for higher parity, ranging from parity of 0 to 4 or more ($p<0.001$). There was no significant association between ethnicity and parity ($p = 0.15$). A significant reverse association was observed between education levels and parity, as 88.2% of the women with 0 parity had more than secondary education while 72.6% of the women who had 4 or more children did not have any education. There was a greater prevalence of unemployed status among women who had given birth to 4 or more children (65.1%), compared to those who had not given to any (13.9%). Significantly more people in the parity group of 4 or more (37.7%) had experienced smoking tobacco compared to the 0-parity group (5.6%). Experience of alcohol consumption was highest among multiparous women with a parity of 4 or more (35.8%), followed by those with a parity of 3 (26.4%), and was lower in other groups such as being 9.7% for the 0-parity group. There was no significant difference among parity groups in physical activity. The prevalence of hypertension in multiparous women was higher, ranging from 17.4% to 23.0%, compared to women who did not give birth to any children (6.9%). Lower parity groups had higher fruit and vegetable consumption (portion/week) and higher consumption of high-sugar food (portion/week). The prevalence of diabetes was the highest in women with a parity of 4 or more (7.5%).

Table 2. Ordinal logistic regression between parity and BMI groups

parity	N	Not OOB† (n=231)	Overweight (n=103)	Obese (n=200)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
0	144	91 (63.2%)	26 (18.1%)	27 (18.8%)	Ref	Ref
1	76	34 (44.7%)	18 (23.7%)	24 (31.6%)	2.04 (1.20-3.47)	1.09 (1.05-3.45)
2	121	37 (30.6%)	27 (22.3%)	57 (47.1%)	3.76 (2.36-6.05)	3.15 (1.72-5.84)
3	87	28 (32.2%)	13 (14.9%)	46 (52.9%)	4.22 (2.50-7.18)	4.02 (1.85-8.91)
4 or more	106	41 (38.7%)	19 (17.9%)	46 (43.4%)	2.95 (1.82-4.83)	2.91 (1.30-6.61)

†Followed WHO recommended BMI cutoff for overweight and obese status on Asian adults. 23 $kg/m^2 \leq$ BMI < 25 kg/m^2 as overweight, 25 $kg/m^2 \leq$ BMI as overweight, and lower than 23kg/m^2 is defined as not OOB(overweight/obese) in this study.

The results of the ordinal logistic regression between parity BMI categories (not OOB, overweight, obese) are presented in conjunction with the participant distribution in each category (Table 2). The results showed that a higher number of births given is associated with higher odds of being overweight or obese. Adjustments were made for all variables listed in Table 1, including age, ethnicity, education level, occupation, tobacco use, alcohol use, physical activity, fruit and vegetable consumption, high-sugar food consumption, diabetes, and hypertension, as these variables were considered potential confounders. After the adjustment, the odds of being in a higher BMI category are 1.09 times higher in parity 1 group (95 CI: 1.05-3.45), 3.15 times higher in the parity 2 group (95 CI: 1.72-5.84), 4.02 times higher in parity 3 group (95 CI: 1.85-8.91) compared to the nulliparous group and 2.91 in 4 or more parity group (95 CI: 1.30-6.61).

Discussion

We aimed to investigate the association between parity and BMI among women aged 18-59 in Dhulikhel, Nepal. This study indicated that having more children is positively associated with being in a higher BMI category of overweight or obese in Dhulikhel women. After adjusting for other factors that could influence the results, women who had given birth to three children had 4.02 times higher odds of being in a higher BMI category of overweight/obese (95% CI: 1.85-8.91) compared to women who had never given birth.

These findings concur with the results of previously published studies. In a cross-sectional study in Peru, higher parity was associated with BMI while the relationship was stronger in rural areas compared to urban areas (Huayanay-Espinoza et al., 2017). A study conducted in Iran with 6447 urban women aged 40-65 years also found a positive association between parity and obesity (Taghdir et al., 2020). These studies, however, had different parity categories compared to our study. The study in Peru used parity categories of 0, 1, and 2 or more, while the study in Iran looked at parity categories using 3 as a single cutoff. Despite these differences, both studies found a positive association between parity and BMI that is consistent with our findings. Furthermore, since our study was conducted in a suburban area, it provides valuable insight into the relationship between parity and BMI in this specific context.

The positive relationship between parity and BMI may be further explained by culturally situated beliefs and postpartum dietary habits in Nepal. A qualitative study shed light on the cultural beliefs of postpartum women avoiding certain foods such as raw or uncooked vegetables and fruits (Adhikari, 2016). The taboo practice of feeding lactating women with ghee, meat, and milk further restricts the mother's diet during postpartum, as they believe that the food they eat affects the baby by breastfeeding. In Davey and Vallianatos, interviewees reported a common belief that consuming certain foods such as tomatoes and leafy green vegetables could be harmful to the baby (Davey & Vallianatos, 2018). It might be plausible that our findings of lower fruit and vegetable consumption among women with higher parity may be related to cultural beliefs surrounding postpartum dietary habits and restrictions. Women may continue to follow such dietary habits as women continue to have more children. Therefore, it is possible that cultural factors are contributing to the observed association between higher parity and higher BMI in this study.

This study carries important implications for the health of women in Nepal. The findings that higher parity is associated with higher BMI highlights the importance of the need to focus on the unique health challenges that women in Nepal are facing, especially in the cultural context. Overweight and obesity prevalence is gradually increasing among Nepal women, accompanied by a rapid rate of urbanization (Ghimire & Vatsa, 2021). Therefore, this study adds to understanding the associated factors of obesity in Nepal in order to potentially develop tailored strategies to reduce the risk of obesity among these women. Efforts to promote healthy diets and lifestyles in parous women are essential, given the higher prevalence of overweight/obese in this population and the unique dietary beliefs on postpartum women in Nepal. To effectively do so, it is imperative to consider the social and cultural context in which they live (Regmi & Madison, 2009). For example, educational programs that not only include these women, but also involve the extended family such as the mother-in-law may be a more effective approach. By taking cultural beliefs into account, such interventions might lead to overcoming the barriers these women might face in addressing obesity and diet change.

There are several strengths to be acknowledged in this study. Firstly, our study used rigorous methodology taking into account a robust range of potential confounders. Also, our sample size was sufficiently large to provide a representative sample of the Dhulikhel population. A random selection of one-third of the total population of the community increases the external validity and generalizability of the study's findings to the wider population.

Our study has several limitations. First, due to the study design, pre-pregnancy weight status was not included in the study. In a 15-year follow up study, women with a higher pre-pregnancy BMI gained more weight during pregnancy and became more overweight over time (Linné et al. 2003). Moreover, the use of a combined category of underweight and normal weight might not have fully captured the strength of the association. Future studies can be done to explore potential differences between these groups. Despite these limitations, our study contributes to the existing literature on the relationship between parity and BMI, especially in the underrepresented and understudied region of South Asia and Nepal.

Conclusion

Our results suggest that higher parity is associated with increased odds of being in a higher BMI category. The odds were the highest in women who gave birth to 3 children. This study holds significance as it is the first to examine the relationship between parity and obesity as the primary research question in Nepal, especially in the suburban Dhulikhel community.

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