ORIGINAL RESEARCH PAPER

Dentistry

ASSOCIATION OF BODY MASS INDEX (BMI) WITH NUTRITIONAL KNOWLEDGE AND SOCIOECONOMIC STATUS AMONG POPULATIONS OF PATNA (BIHAR) – AN OBSERVATIONAL STUDY

KEY WORDS: Awareness, Knowledge, Nutrition, Obesity, Socioeconomic Status

Shivani Singh — Ph.D Scholar, Department of Public Health Dentistry, Bareilly International University, Bareilly, Uttar Pradesh, India

K. K. Shivalingesh — Professor and Head of Department, Department of Public Health Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

ABSTRACT

Introduction: Obesity has become an epidemic problem worldwide. Obesity in individuals is becoming a major public health issue, especially in developing nations that are rapidly changing their dietary habits. The balance of nutritional consumption with metabolic needs in the body has an impact on an individual's nutritional status. AIMS AND **Objectives:** The aim of the present study was to assess the nutritional knowledge of adult population in Patna, Bihar and the objectives of this study was to correlate the nutritional knowledge socioeconomic status (SES) with the body mass index (BMI) of adult population in Patna city. **Materials and Methods:** In our study, a total of 2500 sample size was taken and a house-to-house survey was planned. House to house survey helped to minimize incomplete submission and clarification of the questionnaire was done on the spot if any difficulties were encountered. The questionnaire consisted of four parts. All questions were converted from English to local language (Hindi) so that people could understand it easily. The questionnaires were given to the subjects and were collected after the subjects filled it completely. **Result:** In our study, out of 2500 subjects, maximum subjects were females. The nutritional knowledge was more in females as compared to males. Among single status subjects, 64.8% had normal basal metabolic rate (BMI). **Conclusion:** The study highlights the importance of nutrition education to improve the nutritional knowledge and dietary behaviour. We also found that socioeconomic status plays an important role in having nutritious food in daily diet). Obese participants had the highest nutritional knowledge score compared with all other BMI categories.

INTRODUCTION

The increasing prevalence of obesity and other lifestyle-related disorders, particularly in developing countries, has become a major public health concern. Obesity is a chronic condition characterized by excessive accumulation of body fat, generally defined by a body mass index (BMI) of 30 kg/m^2 or above. Obesity is a multifactorial condition influenced by several factors, including unhealthy dietary patterns, physical inactivity, genetic predisposition, endocrine disorders, socioeconomic status, and occupational factors [1]. Over the past few decades, its prevalence has increased considerably in both developed and developing countries, contributing to the growing burden of non-communicable diseases such as hypertension, type 2 diabetes mellitus, cardiovascular diseases, and certain types of cancer [2].

Nutrition knowledge plays an essential role in promoting healthy dietary practices and preventing obesity. It refers to an individual's understanding of nutritional concepts, dietary requirements, and the relationship between food consumption and health [3]. Such knowledge provides the necessary information for making informed food choices, understanding nutritional labels, and adopting healthier eating habits [4]. Individuals with adequate nutritional knowledge are more likely to recognize the importance of balanced diets and select foods that contribute to better health outcomes [5]. Previous studies have identified nutrition knowledge as a positive predictor of healthy eating behaviour [6]. However, the influence of knowledge on actual dietary practices may be relatively limited, indicating that other factors also contribute to the translation of nutritional awareness into healthy behaviours [7]. Therefore, improving nutritional knowledge and attitudes is important for encouraging positive changes in dietary behaviour [8]. In addition to nutritional knowledge and nutritional awareness, physical activity is an important determinant of overall health and body weight regulation [9]. Unhealthy eating habits combined with inadequate physical activity increase the risk of obesity and associated metabolic disorders [10]. Regular physical activity helps regulate energy expenditure, maintain a healthy body weight and BMI, and reduce the risk of cardiovascular diseases, type 2 diabetes, and hypertension [11]. However, physical inactivity remains a significant public health concern, highlighting the importance of promoting active lifestyles alongside healthy dietary practices [12]. Nutrition knowledge, healthy eating, and physical activity are closely interconnected behaviours that collectively influence an individual's nutritional and health status [13]. Furthermore, social and demographic factors, particularly marital status and social support, may influence dietary behaviour and obesity [14]. Marriage often brings changes in daily routines, food preferences, eating patterns, and lifestyle practices, which may contribute to changes in body weight [15]. According to Dinour et al., marriage was associated with weight gain, whereas divorce was associated with weight reduction in both men and women [16]. Social support from family and friends may also encourage healthier food choices and lifestyle modifications [17,18]. Thus, understanding the combined influence of nutritional knowledge, physical activity, social status, and sociodemographic factors is essential for developing effective strategies to improve dietary behaviour and prevent obesity. Hence, this study was conducted in this part of country to assess the relationship between age, social status and gender with BMI.

MATERIALS AND METHODS

In our study, a total of 2500 sample size was taken and a house-to house survey was planned. House to house survey helped to minimize incomplete submission and clarification of the questionnaire was done on the spot if any difficulties were encountered. The questionnaire consisted of four parts: first part collected the demographic details, second part were related to their diet, third part was related to lifestyle and oral hygiene and the fourth part consisted of nutritional knowledge. All questions were converted from English to local language (Hindi) so that people could understand it easily. The questionnaires were given to the subjects and were collected after the subjects filled it completely. The study was approved by ethical committee of the institute. Data was entered in the Microsoft excel spread sheet and the collected data were subsequently processed and analysed using SPSS statistical package version 22.

RESULT

This study was conducted among adult population of Patna, Bihar, India. All people who are aged 18 years and above, living in Patna, Bihar (Permanent Residents) will constitute the target population. The study sample consisted of 2500 adults

who were selected from house-to-house- survey through multi-stage random sampling technique. Only those subjects were excluded who were in the inebriated state, unavailable at the site on the day of data collection and who were unwilling to give informed written voluntary consent. Maximum subjects 1485 (59%) had BMI between 18.5- 24.9 followed by 557 (22%) subjects who had BMI between 25-29.9. least subjects 111(5%) had BMI >=30. Only 14% subjects had BMI less than 18.5 [Graph 1]. In our study, maximum 42 % (1049) subjects belonged to 18-27 years age group [Table 1]. In the age group of 18-27 years, 247 subjects were found underweight 655 subjects (62.4%) were having BMI 18.5-24.9, 109 (10.4%) subjects were having BMI 25.0-29.9. Only 3.6% (38) subjects had BMI equal to more than 30. In the age group of 28-37 years, total numbers of subjects were 591. Out of these 591 subjects, 8.1% (48) were having BMI less than 18.5, 400(67.7%) were having BMI between 18.5 to 24.9, 24(4.1%) were obese, having BMI equal to more than 30. Least number of subjects (265) were in the age group 48-57 years, only 8 subjects (3%) were having BMI between 18.5 – 24.9, 115(43.3%) subjects had BMI between 25.0-29.9, whereas 31 subjects (11.7%), had BMI equal to more than 30. Table 1 also demonstrates that when subjects in the age group of 18-27 years were compared with other age groups, a highly statistical significant difference in the BMI was observed. Likewise, when other age groups were compared with each other, there were statistical differences but not as pronounced as the 18-27 year age group. Overall relationship between age groups and BMI was statistical significant. When gender wise distribution of subjects according to their BMI was done, it was found that out of 969 males 133 (13.7%) males, were having BMI less than 18.5; 536 (55.3%) were having BMI between 18.5-24.9, 229 were having BMI between 25.0-29.9 and 71 males (7.3%) were having BMI equal to or more than 30. Among 1531 females, 949 (62.0%) were having BMI between 18.5-24.9, 324 (21.4%) females were having BMI between 25.0-29.9. Only 40 (2.6%) subjects were having BMI equal to or more than 30 indicating that females had better BMI than males which was statistically significant [Table 2]. Relationship between BMI with social status of subjects were also assessed. Among 1624 married subjects, 929 subjects (57.2%) had BMI between 18.5-24.9 followed by 438 subjects (27%) had BMI between 25.0-29.9 whereas least 78 (48%) married subjects had BMI >= 30. Among subjects who were single, 548 subjects (64.8%) had BMI between 18.5-24.9, whereas 33 (3.9%) subjects had BMI > = 30. Out of 30 subjects who were divorced, 22 subjects had BMI between 25.0-29.9 and 8 subjects were having BMI between 18.5-24.9. A high statistically significant difference was found when single subjects were compared either with married or divorced subjects. A statistical difference was also observed when divorced subjects were compared with married subjects [Table 3].

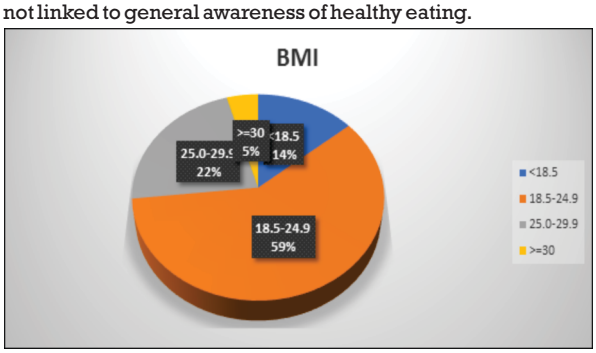
Table 4 shows the relationship between nutritional knowledge score and BMI groups among participants when BMI range of 18.5-24.9 was compared with >=30 and 25-29.9 compared with >=30, a highly statistically significant differences were observed. Significant difference was seen when BMI range of <18.5 to >=30 and <18.5 to 18.5-24.9 was compared. No significant difference was seen in other group.

DISCUSSION

Nutrition knowledge is a significant predictor of physical activity habits so that greater nutrition knowledge is associated with higher level of physical activity. This is probably due to the fact that understanding healthy nutrition guidelines leads to informed behaviours and improves the level of physical activity. In our study, out of 2500 subjects, 347 (13.9%) subjects were underweight [males 133 (13.7%) and females 214 (14%)], 1485 (59.3%) subjects had normal BMI [536 (55.3%) males, 949 (62.%) females], 557 participants (22.3%) were overweight [men, 229 (23.6%), women 328 (21.4%)] and 111 (4.4%) subjects were obese [7.3% (71) men, 2.6% (40) women] which is in accordance with the study conducted by Sangeetha KM *et al.,* Kim HS *et al.,* but it is contrary with result found in a study conducted by A. Al Riyami *et al.,* where higher rate of obesity was found in women (15.7%) than men (10.5%) (P = 0.02) and 31.5% of the total sample was overweight with 7.6% being underweight [19,20,21]. This difference may be due to changes in lifestyle and socioeconomic status have led to more sedentary lifestyles and levels of physical activity have decreased sharply in most Arab countries [22]. Women spent significantly less time in physical activity than men, as most have domestic helpers for daily chores and there is little awareness of the value of walking as exercise.

Changes in lifestyle and socioeconomic status have had a significant effect on physical activity. With the availability of cars, the increase in electrical home appliances and more involvement in office work, life has become more sedentary, and the pattern of practising exercise has diminished steeply in most countries. In various studies worldwide, it has been found that BMI and marital dissolution are not only correlated but there is a casual link. BMI can deter marital dissolution since overweight are more likely to stay married. Women appear to be more affected by their BMI in marriage. In our study, obesity was more common in married subjects as compared to single and divorced. In this study, 929 (62.5%) married and 548 (37%) subjects had normal BMI. Out of 2500 subjects, 784 (48.3%) married subjects didn't do any kind of exercise compared to 249 (29.4%) single subjects. 711 (43.8%) subjects who were married did daily exercise compared to 343 single subjects. In our study, it was found that 438 (27%) married subjects were overweight compared to only 97 (11.5%) subjects who were single were found to be overweight. 1497 (92.2%) married subjects won't skip any meal, compared to 524 single subjects and 22 divorced subjects. 256 (30.3%) single subjects most commonly skipped breakfast whereas divorced subjects often skipped dinner. These results were in accordance with the result found by Bellido H, Turnic TN *et al.,* and Gouda J [23,24,25].

Pairwise comparisons of nutritional knowledge scores across different BMI categories revealed statistically significant differences between underweight and normal-weight participants (p = 0.04), underweight and obese participants (p = 0.0001), normal-weight and obese participants (p = 0.001), and overweight and obese participants (p = 0.001). However, no statistically significant differences were observed between underweight and overweight participants (p = 0.2) or between normal-weight and overweight participants (p = 0.5). Obese participants demonstrated the highest mean nutritional knowledge score (5.05 ± 1.66), followed by underweight (4.37 ± 1.44), overweight (4.24 ± 1.59), and normal-weight participants (4.19 ± 1.63). Obese participants had the highest nutritional knowledge score compared with all other BMI categories. This suggests that higher nutritional knowledge does not necessarily translate into lower BMI or healthier body weight. There was a clear knowledge-practice gap: normal dietary behaviours, such as knowledge of the importance of fruits and vegetables, were not linked to general awareness of healthy eating.



Graph 1- Shows Percentage Wise Distribution of BMI Among Subjects

Table 01: Relationship Between age and BMI Group

Age				BMI	Total	P-value	Overall comparison between groups
<18.5	18.5 - 24.9	25.0-29.9	> = 30				
18-27 years vs	247	655	109	38	1049	0.001	0.001*
28-37 years	48	400	119	24	591		
18-27 years vs	247	655	109	38	1049	0.001	
38-47 years	34	139	98	16	287		
18-27 years vs	247	655	109	38	1049	0.001	
48-57 years	8	111	115	31	265		
18-27 years vs	247	655	109	38	1049	0.001	
>58 years	10	180	116	2	308		
28-37 years vs	247	655	109	38	1049	0.008	
38-47 years	34	139	98	16	287		
28-37 years vs	48	400	119	24	591	0.001	
48-57 years	8	111	115	31	265		
28-37 years vs	48	400	119	24	591	0.01	
>58 years	10	180	116	2	308		
38-47 years vs	34	139	98	16	287	0.04	
48-57 years	8	111	115	31	265		
38-47 years vs	34	139	98	16	287	0.01	
>58 years	10	180	116	2	308		
48-57 years vs	8	111	115	31	265	0.02	
>58 years	10	180	116	2	308		
	247	655	109	38	1049		

P<0.05 is considered statistically significant

Table 02: Relationship Between Gender and BMI Group

		BMI_ group				Total	P-value
		<18.5	18.5 - 24.9	25.0 - 29.9	>=30		
Gender	Males	133	536	229	71	969	0.001
	Females	214	949	328	40	1531	
Total		347	1485	557	111	2500	

P<0.05 is considered Statistically significant

Table 03: Relationship Between Social Status and BMI GRP

Social Status	BMI grp				Total	P- value
	<18.5	18.5 - 24.9	25.0 - 29.9	>=30		
Married	179	929	438	78	1624	0.001
vs Single	168	548	97	33	846	
Single vs	168	548	97	33	846	0.001
Divorced	0	8	22	0	30	
Divorced	0	8	22	0	30	0.009
vs Married	179	929	438	78	1624	

P<0.05 is considered Statistically significant

Table 04: Nutritional Knowledge Score Between BMI

BMI	N	Mean	Std. Deviation	Std. Error	P – value
<18.5 vs	347	4.3718	1.43757	.07717	0.04
18.5-24.9	1485	4.1933	1.63056	.04231	
<18.5 vs	347	4.3718	1.43757	.07717	0.2
25.0-29.9	557	4.2406	1.58555	.06718	
<18.5 vs >=30	347	4.3718	1.43757	.07717	0.0001
	111	5.0541	1.65605	.15719	
18.5-24.9	1485	4.1933	1.63056	.04231	0.5
Vs 25.0-29.9	557	4.2406	1.58555	.06718	
18.5-24.9 vs	1485	4.1933	1.63056	.04231	0.001
>=30	111	5.0541	1.65605	.15719	
25.0-29.9	557	4.2406	1.58555	.06718	0.001
Vs >=30	111	5.0541	1.65605	.15719	

CONCLUSION

Obesity has emerged as a major global public health concern due to its strong association with various chronic diseases and related health complications. Despite its increasing prevalence, effective strategies for the prevention and management of obesity remain inadequately incorporated into the healthcare policies of many countries. Furthermore, limited quantitative and qualitative research has hindered a comprehensive understanding of the factors contributing to obesity. Therefore, there is an urgent need for effective interventions and evidence-based research to identify its determinants and develop appropriate programmes for obesity prevention and control.

REFERENCES

1. Axelson ML, Brinberg D. The measurement and conceptualization of nutrition knowledge. J Nutr Educ. 1992;24(5):239-46.
2. McKinnon L, Giskes K, Turrell G. The contribution of three components of nutrition knowledge to socioeconomic differences in food purchasing choices. Public Health Nutr. 2014;17:1814-24.
3. Miller LM, Cassady DL. The effects of nutrition knowledge on food label use. A review of the literature. Appetite. 2015;92:207-16.
4. Choi ES, Shin NR, Jung EI, Park HR, Lee HM, Song KH. A study on nutrition knowledge and dietary behaviour of elementary school children in Seoul. Nutr Res Pract. 2008;2(4):308-16.
5. Kruger HS, Venter CS, Vorster HH, Margetts BM. Physical inactivity is the major determinant of obesity in black women in the north west province, South Africa: the THUSA study. Nutrition. 2002;18:422-27.
6. Worsley A. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? Asia Pac J Clin Nutr. 2002;11:579-85.
7. Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge and dietary intake. Br J Nutr. 2014;111:1713-26.
8. Amenya PCA, Annan RA, Apprey C, et al. The relationship between nutrition and physical activity knowledge and body mass index-for-age of school-aged children in selected schools in Ghana. Heliyon. 2021;7:e08298.
9. Laz TH, Rahman M, Pohlmeier AM, et al. Level of nutrition knowledge and its association with weight loss behaviors among low-income reproductive-age women. J Community Health. 2015;40:542-8.
10. Mogre V, Gaa PK, Abukari RNS. Overweight, Obesity and Thinness and Associated Factors Among School-aged Children (5-14 years) in Tamale, Northern Ghana. Eur Sci J. 2013;9:1857-7881.
11. Mogre V, Gaa PK, Abukari RNS. Overweight, obesity and thinness and associated factors among school-aged children (5-14 years) in Tamale, Northern Ghana. Eur Sci J. 2013;9.
12. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess. 1988;52:30-41.
13. Albrecht TL, Goldsmith DJ. Social support, social networks, and health. In: Thompson TL, Dorsey AM, Miller KI, Parrott R, eds. Handbook of Health Communication. Mahwah, NJ: Lawrence Erlbaum; 2003:263-84.
14. McKinley CJ. Investigating the influence of threat appraisals and social support on healthy eating behavior and drive for thinness. Health Commun. 2009;24:735-45.
15. Tamers SL, Beresford SA, Cheadle AD, Zheng Y, Bishop SK, Thompson B. The association between worksite social support, diet, physical activity and body mass index. J Prev Med. 2011;53(1-2):53-56.
16. Dinour, L.; Leung, M.M.; Tripicchio, G.; Khan, S.; Yeh, M.-C. The Association between Marital Transitions, Body Mass Index, and Weight: A Review of the Literature. J. Obes. 2012,1-16.
17. Thornton PL, Kieffer EC, Salabarria-Pena Y, et al. Weight, diet, and physical activity–related beliefs and practices among pregnant and postpartum Latino women: the role of social support. Matern Child Health J. 2006;10:95-104.
18. Herzer M, Zeller MH, Rausch J, Modi AC. Family and peer social support as specific association with obesity-specific health-related quality of life. J Dev Behav Pediatr. 2011;32(3):188-195.
19. Sangeetha KM, Ramaswamy L, Jisna PK. Assessment of Nutritional Status, Nutritional Knowledge and Impact of Nutrition Education among Selected Sports Persons of Coimbatore District. International Journal of Science and Research 2014;11(3):970-8.
20. Singh BP, Chaudhary AN, Jolly, Fazal K. Evaluation of Knowledge, Attitude, and Practices Regarding Nutritional Awareness among Healthcare Professionals. International Journal of Pharmaceutical and Clinical Research 2024; 16(4): 1392-5.
21. Al Riyami A, Al Hadabi S, Abd El Aty MA, Al Kharusi H, Morsi M, Jaju S. Nutrition knowledge, beliefs and dietary habits among elderly people in Nizwa, Oman: implications for policy. East Mediterr Health J 2010;16(8):859-67.
22. Musaiger AO. Overweight and obesity in the Eastern Mediterranean Region: can we control it? East Mediterr Health J 2004;10(6):789-793.
23. Bellido H, Marcén M. On the Relationship between BMI and Marital Dissolution, Economic Modelling 2020;91:326-40.
24. Saeidlou SN, Babaei F, Ayremlou P. Nutritional Knowledge, Attitude and Practice of North West Households in Iran: Is Knowledge likely to Become Practice. MAEDICA 2016;11(4):286-95.
25. Gouda J, Prusty RK. Overweight and obesity among women by economic stratum in urban India. J Health Popul. Nutr. 2014,32(1):79-88.