Biological Forum – An International Journal **16(11): 95-101(2024)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Assessment of Food Consumption Pattern and Lifestyle Profile of Pre-Diabetic and Type 2 Diabetic Adults in Bhubaneswar City, Odisha

Tanmayee Mousumee Maharana[1], Snehalata Nanda[2], Suryamani Patro[1]* and Anmayee Nanda[1]
[1]Department of Home Science, Rama Devi Women's University, Bhubaneswar (Odisha), India.
[2]Department of Home Science, College of Community Science, OUAT, Bhubaneswar (Odisha), India.

(Corresponding author: Suryamani Patro)*
(Received: 16 August 2024; Revised: 16 September 2024; Accepted: 14 October 2024; Published: 14 November 2024)
(Published by Research Trend)

ABSTRACT: Diabetes and pre-diabetes are rising health concerns in urban India, influenced by lifestyle changes and dietary patterns. This study aims to assess food consumption and lifestyle profiles of pre-diabetic and Type 2 diabetic adults in Bhubaneswar City, Odisha, to identify contributing factors for preventive measures. A cross-sectional study of 100 adults (aged 35-55 years, 50 from each gender) was conducted to collect data on dietary intake, physical activity, and lifestyle habits. Semi structured questionnaires and 24-hour dietary recalls were used for date collection. Findings showed high consumption of refined carbohydrates, processed foods, and low fiber intake. A significant association between fast food consumption, physical activity, and both fasting and postprandial blood sugar levels was observed. The study concludes that adopting healthier diets and active lifestyles is critical for diabetes prevention. Public health efforts should focus on dietary education and lifestyle modification for effective intervention.

Keywords: Type 2 Diabetes Mellitus, Lifestyle Choices, Dietary Habits, Hyperglycemia.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a significant global health issue affecting adults around the world. Currently, approximately one in ten adults aged 20 to 79 is affected by diabetes. According to the International Diabetes Federation, the number of people living with diabetes was about 537 million in 2021 and is projected to rise to 643 million by 2030 and 783 million by 2045. The majority of these cases are found in low- and middle-income countries, where an estimated 69% of all diabetes cases are expected to occur by 2030. In 2021 alone, diabetes was linked to approximately 6.7 million deaths.

Diabetes is a multifaceted metabolic disorder marked by high blood sugar levels, resulting from a combination of genetic predispositions and environmental factors (Ojo, 2019). T2DM risk factors range from non-modifiable factors, such as age, genetics, and ethnicity, to lifestyle factors, such as high-calorie diets and reduced physical activity. Urbanization and economic development have also contributed to unhealthy lifestyle changes, such as poor dietary habits and physical inactivity, which drive the growing incidence of obesity—a primary factor in the rapid increase of T2DM cases (Hu *et al*., 2011; Schwingshackl *et al*., 2017).

Given the significant economic and health impacts of T2DM, its prevention and management have become global priorities (Ley *et al*., 2014). Research has shown that certain foods are closely associated with T2DM risk, though these relationships are complex because individuals typically consume mixed diets rather than isolated foods. For this reason, studying dietary patterns provides valuable insights into the nutritional factors linked to diabetes risk and can help improve blood glucose regulation.

Thus, this study aims to assess physical activity levels, dietary patterns, and intake among individuals with pre diabetic and T2DM, as well as to evaluate influence of these factors on the blood glucose levels.

MATERIALS AND METHODS

Study Design: The present study is a cross-sectional study conducted at different locations of Bhubaneswar, Odisha.

Study Population: Adults (both male and female) aged 35 to 55 years were included as respondents in this study.

Inclusion criteria

1. Adults with a blood sugar level above 100 mg/dL.
2. Individuals diagnosed with Type 2 Diabetes for more than six months.
3. Individuals aged 35 to 55 years.

Exclusion criteria

1. Individuals with Type 1 diabetes.
2. Patients with gestational diabetes (pregnant women).
3. Individuals not within the age range of 35-55 years.

Sampling Method. The city of Bhubaneswar, Odisha, was purposefully selected as the study location due to its diverse population and the availability of healthcare

facilities, which aids in accessing individuals with varying blood sugar levels and diabetes status.

A simple random sampling technique was employed to select 100 (50 male and 50 female) number of representative adults aged 35 to 55 years with blood sugar level more than 100 mg/dL from different healthcare centers and local clinics within the city.

Data Collection Tools and procedure. The respondents were interviewed by a pretested semi structured questionnaire to collect information regarding food consumption pattern and lifestyle including physical activity and stress related variables. Food frequency questionnaires (FFQ) and 24-hour dietary recall was used to record the food intake of the respondents and nutrient intake was calculated with the help of food composition table (Gopalan, 1989). Fasting blood sugar and postprandial blood sugar level was recorded from the recent medical report of the respondents.

Data Analysis. The collected data were analyzed through by using SPSS software. Percentage, mean, standard deviation and chi square tests were used to interpret the data.

RESULTS AND DISCUSSION

Diet plays a crucial role in regulating metabolism and body weight, making it essential for the management and prevention of Type 2 Diabetes Mellitus (T2DM) [American Diabetes Association Standards of Medical Care in Diabetes (2019)]. As shown in Table 1, the food habits and dietary practices of the respondents were analyzed.

Table 1: Distribution of respondents according to Dietary behavior (N=100).

Variables	Frequency (%)	
	Male	Female
Vegetarian	6(12.0)	4 (8.0)
Non Vegetarian	44(88.0)	46(92.0)
Food allergy	5(10.0)	3(6.0)
Vegetables with peels	21(42.0)	13(26.0)
Fruits along with outer skin	19(38.0)	12(24.0)
Whole fruits	29(58.0)	19(38.0)
Processed fruits	21(42.0)	26(52.0)
Juice	19(38.0)	14(28.0)
Squash	4(8.0)	16(32.0)
Raw rice	19(38.0)	18(36.0)
Parboiled rice	31(62.0)	32(64.0)
Whole dal	13(26.0)	11(22.0)
Whole milk	17(34.0)	22(44.0)
Skimmed milk	9(18.0)	9(18.0)
Refined oil	19(38.0)	35(70.0)
Mustard oil	11(22.0)	7(14.0)
Consuming fast food	11 (22.0)	9 (18.0)

The majority of respondents identified as non-vegetarian, which aligns with the study conducted among rural diabetic adults of Mysur (Nishchitha *et al.*, 2021). Notably, food allergies were not commonly reported among the respondents, and fast food consumption was relatively low, with only 18-22% expressing a preference for it. In a related study among Diabetic Patients at the Bono Regional Hospital, Ghana, it was found that found that 32% of respondents consumed fast food one to three times a week (Dawudaa *et al.*, 2023).

The analysis of food consumption patterns revealed that a larger proportion of male respondents consumed whole vegetables (42%) and whole fruits (58%) compared to female respondents. In contrast, processed fruit consumption was higher among females (52%). Additionally, female respondents were more likely to consume fruit in the form of juice and squash (60%) than males. Whole dal was consumed by 22-26% of the respondents, while parboiled rice was preferred by more than 60%, compared to only 37% who opted for raw rice.

In terms of dairy consumption, whole milk was favored by 44% of female respondents, whereas 34% of males preferred it. Only 18% chose skim milk. This is in contrast with a study conducted in Deoria, Uttar Pradesh, which found that 26% of respondents consumed full-cream milk, 53% skim milk, and 21% did not drink any milk (Anand *et al.*, 2020). Additionally, the study highlighted that most respondents did not use whole wheat flour.

Refined oil was the preferred choice for 70% of female respondents, while less than 40% of males favored it. Mustard oil was selected by only 14% of females and 22% of males.

Table 2: Distribution of respondents according to Frequency of consumption of food stuffs.

Food Groups	Daily		Weekly once		Weekly twice		Fort nightly	
	Male No. (%)	Female No. (%)	Male No. (%)	Female No. (%)	Male No. (%)	Female No. (%)	Male No. (%)	Female No. (%)
Cereals	50 (100.0)	50 (100.0)	-	-	-	-	-	-
Pulses	50(100.0)	50(100.0)	-	-	-	-	-	-
Fruits	16(32.0)	13(26.0)	3(6.0)	4(8.0)	17(34.0)	22(44.0)	14(28.0)	6(12.0)
Green leafy Vegetables	16(32.0)	8(16.0)	5(10.0)	9(18.0)	16(32.0)	18(36.0)	10(20.0)	10(20.0)
Other Vegetables	34 (78.0)	29 (58.0)	5 (10.0)	6 (12.0)	11 (22.0)	12 (24.0)	-	-
Roots & Tubers	24(48.0)	25(50.0)	6(12.0)	12(24.0)	11(22.0)	9(18.0)	9(18.0)	4(8.0)
Egg	-	2(4.0)	14(28.0)	15(30.0)	21(42.0)	23(46.0)	9(18.0)	5(10.0)
Poultry, Meat	-	-	28(56.0)	26(52.0)	8(16.0)	10(20.0)	8(16.0)	7(14.0)
Fish	-	-	19(38.0)	29(58.0)	23(46.0)	14(28.0)	3(6.0)	4(8.0)
Meat	-	-	18(36.0)	16(32.0)	-	-	25(50.0)	27(54.0)
Tea/ Coffee	34(68.0)	35(70.0)	-	5(10.0)	8(16.0)	7(14.0)	-	-
Milk and milk products	17(34.0)	18(36.0)	8(16.0)	10(20.0)	20(40.0)	19(38.0)	5(10.0)	3(6.0)
Sugar & Jaggery	-	2(4.0)	9(18.0)	10(20.0)	1(2.0)	12(24.0)	16(32.0)	13(26.0)
Nuts & Oilseeds	-	-	-	-	-	-	14(28.0)	9(18.0)

The frequency of food consumption among respondents is detailed in Table 2. Cereals and pulses were identified as staple foods, consistently consumed by all participants. Similar finding was also observed among type 2 diabetes in rural area of Mysuru. An average daily intake of 307.11 grams of cereals and 32 grams of pulses was observed (Nishchitha *et al.,* 2021).

Fruits were primarily consumed twice a week by 44% of female respondents and 34% of male respondents. Daily consumption was noted in 32% of male and 16% of female respondents, while 28% of males and 12% of females consumed fruits fortnightly. Less than 10% of both sexes reported eating fruits once a week. A similar pattern was observed for green leafy vegetables, with over 30% consuming them twice a week. Daily consumption was reported by 32% of males and 16% of females, while around 20% consumed them either fortnightly or weekly.

In terms of other vegetables, a majority of male respondents (78%) and 58% of female respondents consumed them daily, with over 20% eating them twice a week. A small percentage (about 11%) consumed other vegetables once a week. Approximately half of the female respondents and slightly fewer males consumed roots and tubers regularly, while 10-24% consumed them weekly, twice a week, or fortnightly.

Animal protein sources were consumed less frequently, with eggs being the most common; only 4% of respondents consumed them daily, while more than 40% had them twice a week. Weekly consumption of eggs was reported by 28% of males and 30% of females, with less than 20% eating them fortnightly. More than half of the respondents consumed poultry weekly, with 14-20% consuming it twice a week or fortnightly. Fish consumption was reported weekly by over half of the females, while 46% of males consumed it twice a week, with fewer than 10% eating it fortnightly.

Other meats were typically consumed fortnightly by half of the respondents, and slightly more than 30% consumed them weekly. Tea and coffee were regular habits for the majority, while over 30% consumed milk and dairy products daily and around 40% twice a week. More than 25% consumed sugar and jaggery fortnightly, with fewer than 20% eating them weekly. Nuts and oilseeds were consumed fortnightly by 18% of females and 28% of males.

The study recorded that only 3.1% reported daily fruit consumption, with 2.6% eating fruits weekly and 23.7% monthly. Rural diabetic adults of Mysuru were observed to consume green leafy vegetables and other vegetables weekly (Nishchitha *et al.,* 2021). A negligible number of respondents consumed eggs daily, and 7.3% did so once a month. Fish was eaten monthly by 27.9% of participants, while beef and poultry were consumed weekly by 78.4%.

Research findings highlighted that fruit and vegetable consumption correlated with body mass, with normal weight diabetic patients consuming a higher average (492.74 g/day) than overweight and obese diabetics (Laissaoui and Allem 2016). Weekly consumption of meat, fish, and eggs (MFE) was relatively low among normal weight diabetics compared to their overweight counterparts, with no significant difference ($P > 0.05$).

Additionally, it was noted that 67% of female and 73% of male respondents consumed chicken and red meat more than twice a week, while over 70% regularly ate lentils. In another study, consumption of fried foods and excessive saturated fats was reported by 18% and 21% of respondents, respectively (Rashid *et al.,* 2023).

Table 3: Distribution of respondents according to Nutrient intake (N=100).

Nutrients	Male		Female	
	Reference value (RDA, 2020)	Observed value (Mean±SD)	Reference value (RDA,2020)	Observed value (Mean±SD)
Energy (k cal)	2110	2154.3±399.67	1660	1795.315±395.467
Protein (gm)	54	52.60 ±12.24	45.7	40.992±6.358
Fat (gm)	25	28.081±10.203	20	23.74±5.92
Fibre (gm)	30	13.054±3.396	30	13.704±2.524
CHO (gm)	130	297.28±64.68	130	203.172±50.85
Calcium (mg)	1000	431.566±168.11	1000	306.19±129.52
Iron (mg)	19	15.65±3.47	29	15.77±5.33
Vitamin-A (β carotene)µg	1000	614.296±264.49	840	994.003±543.198

Higher diet quality is linked to a reduced risk of Type 2 Diabetes Mellitus (T2DM) (Fung *et al*., 2021) and better glucose control (Antonio *et al*., 2019). Additionally, a nutritious diet is associated with various metabolic biomarkers and risk factors in individuals with T2DM. In contrast, lower diet quality is correlated with increased risks of hyperglycemia, dyslipidemia, and excess weight among adults with T2DM (Sanjeevi *et al*., 2023).

To assess dietary quality, nutrient intake was evaluated and presented in Table 3. The mean intake of calories, carbohydrates, fat, and Vitamin A exceeded reference values among the respondents, while intake of all other nutrients fell below the recommended levels. Male respondents consumed slightly more calories than the Recommended Dietary Allowance (RDA), whereas female respondents showed a larger deficit. Both male and female respondents had fiber and calcium intakes significantly below the reference values. Interestingly, while male respondents had a Vitamin A intake lower than the recommended level, female respondents exceeded it.

Low fiber intake among respondents was also reported among diabetic Patients at Sunyani, Ghana (Dawudaa *et al*., 2023). Similarly, Thewjitcharoen *et al.* (2018) noted that their participants had low intakes of saturated fat (<10% of total energy), free sugars (≤5% of total energy), and fiber (≥14 grams per 1000 kcal).

Table 4: Distribution of respondents according to life style practices (N=100).

Variables		Total number of respondents	Male(n=50) No. (%)	Female (n=50) No. (%)
Physical activity				
Regular exercise		47	29(58.0)	18(36.0)
Morning walk		20	12(24.0)	8(16.0)
Yoga		25	15(30.0)	10(20.0)
Swimming		2	2(4.0)	-
Sleep pattern				
Time spent in sleeping	<6hrs	71	39 (78.0)	32 (64.0)
	6-8hrs	17	7 (14.0)	10 (20.0)
	>8hrs	12	4 (8.0)	8 (16.0)
Stress experiences				
Marital stress		16	6(12.0)	10(20.0)
Work related stress		12	4(8.0)	8(16.0)
Health related stress		27	15(30.0)	12(24.0)
Addiction practices				
Smoking		9	9(18.0)	-
Alcohol		11	11(22.0)	-
Betel		31	18 (36.0)	13 (26.0)
Tobacco		9	6 (12.0)	3 (6.0)

Unhealthy lifestyle behaviors are a significant risk factor in the development of Type 2 Diabetes Mellitus (T2DM). Various lifestyle factors, including physical activity, sleep patterns, stress, and addiction behaviors, were analyzed and are presented in Table 4.

A higher percentage of male respondents (58%) reported engaging in regular exercise, primarily walking and yoga, compared to less than 40% of female respondents. Only 4% of male respondents practiced swimming.

The World Health Organization recommends at least 150 minutes of moderate-intensity aerobic activity each week, such as jogging, swimming, cycling, or brisk walking, along with flexibility, balance, and strength exercises at least two to three times a week [World Health Organization. Global Recommendations on physical activity for health, (2010). In a study it was found that 69% of participants never exercised, while only 14% exercised daily (Senadheera *et al.*, 2016). In another study conducted among diabetic adults, it was reported that 34% of respondents engaged in physical activity, with men constituting 52% and women 48% (Rashid *et al.*, 2023).

Sleep patterns revealed that over 70% of respondents slept for less than 6 hours, while only 17% managed to

sleep for 6 to 8 hours, and a mere 12% reported sleeping for more than 8 hours.

Regarding stress, health-related stress was reported by 27% of respondents, followed by marital stress (16%) and work-related stress (12%). Additionally, a substantial portion (60%) of respondents reported addictions to various substances, with 31% addicted to betel, 11% to alcohol, and less than 10% to either chewing tobacco or smoking. A study conducted among Type 2 Diabetes in Subotica, found that only 25% of respondents consumed alcohol, with men drinking more frequently than women (14%). The study also noted that 22 patients were habitual smokers, averaging ten cigarettes per day (Požar *et al*., 2016).

Table 5: Distribution of respondents according to performance of physical activities (N=100).

Variables	Specifications	Total	Male (n=50) No. (%)	Female (n=50) No. (%)
Performing household work	Yes	58	14 (28.0)	44 (88.0)
	No	42	36 (72.0)	6 (12.0)
Mode of transport to work place	Cycle	2	2 (4.0)	-
	Walking	6	4 (8.0)	2 (4.0)
	Bus	12	5 (10.0)	7 (14.0)
	Bike/ scooty	46	31 (62.0)	15 (30.0)
Using energy saving devices	Yes	88	42 (84.0)	46 (92.0)
	No	12	8 (16.0)	4 (8.0)

The physical activity levels among respondents, including household chores, modes of transportation, and the use of energy-saving devices, are detailed in Table 5. It was noted that 58% of respondents participated in household work, with 44% of that group being female. Additionally, only a small number of respondents reported walking or cycling to their workplaces. Most respondents primarily used bikes or scooters as their main mode of transportation. Furthermore, a significant 88% of respondents utilized energy-saving devices for household tasks.

Table 6: Association between fast food consumption and blood sugar level.

Fast food Consumption	*FBS (mg/dl)*			PPBS (mg/dl)			Total
	100-110	111-125	>125	<140	140-200	>200	
Yes	3	7	10	5	7	8	20
No	21	13	5	22	11	6	39
Total	25	20	14	27	18	14	59
	χ^2Calculated value:12.1			χ^2Calculated value:6.42			
χ^2Table value: 5.99, d.f: 2 at 5% and 1% level of significance							

The consumption of fried and fast foods has been closely linked to Type 2 Diabetes (T2D) (Cahill *et al*., 2014). Table 6 presents the relationship between fast food consumption and blood sugar levels. The calculated χ^2 values (12.1 and 6.42) exceeded the critical value from the χ^2 table (5.99), indicating that an increase in fast food consumption among respondents was associated with higher fasting and postprandial blood sugar levels.

Recent research has shown that the intake of grilled, sugary, and processed foods is related to lower fasting plasma glucose levels. Moreover, meals high in fat have been associated with impaired glucose tolerance (IGT). There is also evidence connecting processed food consumption with combined glucose intolerance (Pramono *et al.*, 2023).

Table 7: Association between blood sugar level and physical activity.

Physical activity	FBS mg/dl			PPBS mg/dl			
	<110	110-125	>125	<140	140-200	>200	Total
Yes	24	15	8	22	16	8	47
No	11	17	25	13	19	22	53
Total	35	32	33	33	35	30	100
	χ^2Calculated value: 15.35			χ^2Calculated value: 8.51			
χ^2Table value: 5.99, d.f: 2 at 5% level of significance							

Regular exercise is associated with prevention and minimization of weight gain, reduction in blood pressure, improvement in insulin sensitivity and glucose control, and optimization of lipoprotein profile, all of which are independent risk factors for the development of T2D (Pramono *et al.*, 2023; Piercy *et al*., 2018).

The relationship between physical activity and both fasting and postprandial blood sugar levels was assessed using χ^2 analysis, as shown in Table 7. The calculated χ^2 values exceeded the critical table values, indicating a statistically significant association between physical activity and both fasting and postprandial blood sugar levels.

Research has indicated that glycemic regulation is more effectively achieved through a combination of resistance and aerobic training than through either type of exercise alone. High-intensity exercise, particularly

high-intensity interval training, has also been shown to have beneficial effects on diabetes management (Zheng *et al*., 2020). A meta-analysis found that diabetic patients who engaged in regular physical activity experienced blood glucose control that was 2.4 times better than those who did not. According to Ambelu and Teferi (2023), fasting blood glucose waw significantly lower in the combined (aerobic plus strength) treatment, indicating that the combined exercise intervention was more successful in altering the blood glucose levels (Ambelu and Teferi 2023).

CONCLUSIONS

In conclusion, the dietary habits of diabetic individuals in Bhubaneswar are significantly influenced by cultural preferences, economic factors, and the urban environment. While there is a general awareness of dietary needs among this population, practical challenges such as the availability of unhealthy food options, financial constraints, and traditional eating practices complicate adherence to recommended diets. To enhance diabetes management, it is crucial to implement targeted interventions that promote healthy eating while respecting cultural traditions. Educational programs should focus on practical strategies for meal planning and preparation, alongside initiatives to improve access to fresh and affordable produce. Furthermore, collaboration between local governments, healthcare providers, and community organizations can help create a supportive environment for healthier dietary choices. By addressing these multifaceted issues, we can improve the dietary habits and overall health outcomes of diabetics in Bhubaneswar, fostering a healthier community.

FUTURE SCOPE

Future studies could expand on this work by conducting longitudinal research to observe changes over time in dietary habits and diabetes progression. Expanding the sample size to include diverse populations across regions would improve generalizability. Adding biomarker analysis, such as HbA1c and lipid profiles, could offer more precise insights into diet-related physiological impacts. Interventional studies to test specific dietary and physical activity programs would provide practical strategies for diabetes prevention. Additionally, exploring psychological factors like stress and motivation could help understand adherence to lifestyle changes in diabetes management.

Acknowledgement. We acknowledge the contributions of Dr. G. Bulliyya, Scientist, Regional Medical Research Centre, Bhubaneswar for his technical support in the clinical and biochemical aspects of the work.

Conflicts of Interest. None.

REFERENCES

Ambelu, T. & Teferi, G. (2023). The impact of exercise modalities on blood glucose, blood pressure and body composition in patients with type 2 diabetes mellitus. *BMC Sports Sci Med Rehabil, 15*, 153.

American Diabetes Association Standards of Medical Care in Diabetes (2019). Abridged for Primary Care Providers. *Clin. Diabetes, 37*, 11–34.

American Diabetes Association. 2. Classification and diagnosis of diabetes: standards of medical Care in Diabetes-2019. (2019). *Diabetes Care, 42*, 13–28.

Anand, T., Das, B., Ali, T., Gupta, K. & Mohanty, C. (2020). Study of dietary pattern, and lifestyles among Type-2 diabetic patients. *IP Journal of Nutrition, Metabolism and Health Science*, *3*(4), 135–140.

Antonio, J. P., Sarmento, R. A. & De Almeida, J. C. (2019). Diet Quality and Glycemic Control in Patients with Type 2 Diabetes. *J. Acad. Nutr. Diet, 119*, 652–658.

Cahill, L. E., Pan, A. & Chiuve, S. E. (2014). Fried-food consumption and risk of type 2 diabetes and coronary artery disease: a prospective study in 2 cohorts of us women and men. *The American Journal of Clinical Nutrition, 100*, 667–675.

Committee PAGA (2018). Physical Activity Guidelines Advisory Committee Scientific Report. Washington, DC: U.S. Department of Health and Human Services.

Dawudaa, A., & Abdul-Aziz, A. (2023). Nutritional Knowledge and Dietary Habits among Diabetic Patients at the Bono Regional Hospital, Sunyani, Ghana. *Journal of Advances in Medical and Pharmaceutical Sciences*, *25*(9), 18-37.

Fung, T. T., Li, Y., Bhupathiraju, S.N., Bromage, S., Batis, C., Holmes, M. D., Stampfer, M., Hu, F. B., Deitchler, M. & Willett, W. C. (2021**).** Higher Global Diet Quality Score Is Inversely Associated with Risk of Type 2 Diabetes in US Women. *J. Nutr, 151*, 168S–175S.

Gopalan, C. (1989). Nutritive Value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad.

Hu, F. B. (2011**).** Globalization of diabetes: The role of diet, lifestyle, and genes. *Diabetes Care, 34*, 1249–1257.

Laissaoui, A. & Allem, R. (2016). The eating habits of Patients with Type 2 diabetes in Algeria. *Pak J Med Sci*., *32*(2), 289-293.

Ley, S. H., Hamdy, O., Mohan, V., & Hu, F. B. (2014). Prevention and management of type 2 diabetes: Dietary components and nutritional strategies. *Lancet, 383*, 1999–2007.

Nishchitha, S., Kumar, S., Chandan, N., Gopi, A., Murthy, N. & Bilimale, A. (2021). Dietary pattern among type 2 diabetes in rural area of Mysuru. *International Journal of Community Medicine and Public Health*, *8*(10), 4909-4913.

Ojo, O. (2019). Dietary Intake and Type 2 Diabetes. *Nutrients, 11*, 2177.

Piercy, K. L. & Troiano, R. P. (2018**).** Physical Activity Guidelines for Americans from the US Department of Health and Human Services. *Circ Cardiovasc Qual Outcomes, 11*(11), e005263

Požar, H., Simin, D. & Požar, C. (2022). Dietary and Lifestyle Habits of Patients with Type 2 Diabetes in Subotica. *Acta facultatis medicae Naissensis*, *39*(3), 318-330.

Pramono, A., Fitranti, D., Nugroho, K., Sobirin, M. & Syauqy, A. (2023). The Association between Unhealthy Food Consumption and Impaired Glucose Metabolism among Adults with Overweight or Obesity: A Cross-Sectional Analysis of the Indonesian Population. *Journal of Obesity*, 1-10.

Rashid, T., Afnan, B., Baloch, A., Mughal, S., Hasan, M., Khan, M. (2023). Dietary Patterns and Physical Activity Levels Among People with Type 2 Diabetes. *Nutrition and Metabolic Insights, 16*, 1–9.

Sanjeevi, N. & Freeland-Graves, J. H. (2023). Low Diet Quality Is Associated with Adverse Levels of Metabolic Health Markers and Clustering of Risk Factors in Adults with Type 2 Diabetes. *J. Hum. Nutr. Diet, 36*, 31–39.

Schwingshackl, L., Hoffmann, G., Lampousi, A. M., Knuppe, S., Iqbal, K., Schwedhelm, C., Bechthold, A., Schlesinger, S. & Boeing, H. (2017). Food groups and risk of type 2 diabetes mellitus: A systematic review and meta-analysis of prospective studies. *Eur. J. Epidemiol*, *32*, 363–375.

Senadheera, S., Ekanayake, S. & Wanigatunge, C. (2016). Dietary Habits of Type 2 Diabetes Patients: Variety and Frequency of Food Intake. *Journal of Nutrition and Metabolism*, 1-6.

Singh, R., Kumar, A. & Kansal, S. (2019). Association of Pre-Diabetes, Diabetes and BMI with family history: A Cross Sectional study in an urban area of Varanasi. *Indian J Prev Soc Med*, *50*(1), 7.

Thewjitcharoen, Y., Chotwanvirat, P., Jantawan, A., Siwasaranond, N., Saetung, S., Nimitphong, H., Himathongkam, T. and Reutrakul, S. (2018). Evaluation of Dietary Intakes and Nutritional Knowledge in Thai Patients with Type 2 Diabetes Mellitus. *Journal of Diabetes Research*, 1-11.

World Health Organization. Global Recommendations on physical activity for health, (2010).

Zheng, X., Qi, Y., Bi, L., Shi, W., Zhang, Y., Zhao, D., Hu, S., Li, M., & Li, Q. (2020). Effects of Exercise on Blood Glucose and Glycemic Variability in Type 2 Diabetic Patients with Dawn Phenomenon. *Biomed Res Int*, 1-6.

How to cite this article: Tanmayee Mousumee Maharana, Snehalata Nanda, Suryamani Patro and Anmayee Nanda (2024). Assessment of Food Consumption Pattern and Lifestyle Profile of Pre-Diabetic and Type 2 Diabetic Adults in Bhubaneswar City, Odisha. *Biological Forum – An International Journal*, *16*(11): 95-101.