# Morbidity Profile of Sedentary Workers in a Food Packaging Industry in Goa: A Retrospective Record-Based Study

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**Abstract:**

**Introduction:** With the advent of mechanization and technological advancement, there is an increase in sedentary and light intensity nature of work in the food manufacturing industry. **Objective:** To describe the morbidity profile of sedentary workers and factors associated with it in a food packaging industry in Goa. **Method:** A retrospective record-based study was conducted for a period of 3 months on 523 workers from food packaging industry in North Goa who are registered with an Occupational Health Service. Morbid conditions such as common chronic diseases like Diabetes, Hypertension, Visual and auditory problems were studied. Continuous data with normal distribution were expressed as mean and standard deviation. Morbidity profile was depicted as frequency and percentage and association with appropriate statistical test. **Results:** Majority, i.e. 495 workers (94.6%) did not have any co-morbidity, 17 (3.3%) had hypertension, 7 (1.3%) had diabetes and 4 (0.8%) had both diabetes and hypertension. Age ≥30 years (p=0.000), presence of comorbidities (p=0.011), near vision (p=0.000), total vision (p=0.031) and blood pressure (p=0.002) were significantly associated with being overweight or obese. A low positive correlation was observed between Body Mass Index and systolic blood pressure (r=0.232, p=0.000), diastolic blood pressure (r=0.166, p=0.000) and Random Blood Sugar Level (r=0.089, p=0.042). **Conclusion:** Workers from the food packaging industry suffer from diabetes, hypertension and overweight, which are known to progress with prolonged periods of reduced physical activity as seen at their workplace.

**Keywords:** Food packaging industry, Goa, Morbidity, Sedentary workers

## Introduction:

Globally, the packaging industry sector has positioned itself as the third largest industry and is one of the fastest growing industries across all countries thus generating ample of employment. However, with the advent of mechanization and technological advancement, there is an increase in the sedentary and light intensity nature of work in this sector. For many of these workers, it is not uncommon to remain seated for well over an hour without standing.

Evidence demonstrates that sedentary behaviour contributes to mortality by doubling the risk of non-communicable diseases like; cardiovascular diseases, type II diabetes, obesity, several types of cancers and musculoskeletal conditions.[1,2]

Approximately two million deaths per year are attributed to physical inactivity, prompting WHO to issue a warning that a sedentary behaviour could very well be among the 10 leading causes of death and disability in the world.[3]

A considerable number of individuals work in the manufacturing sector like the food packaging industry but with limited access to occupational health services. Very few studies have reported adverse health effects of

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sedentary behaviour. There is a scarcity of manpower needed to assess and address diseases related to occupational health. Most of the workers from the industrial sector are outside the panorama of even the existing provisions of health care. If the industrial sector of India is to be at par with other nations, it cannot afford to be neglectful of the health of its workers. This study was conducted considering the importance of the subject and the lack of published evidence.

**Objective:**

1. To describe the morbidity profile of sedentary workers at the food packaging industry at Goa.
2. To find out the factors associated with the morbid conditions

**Method:**

**Study design and duration**

Aretrospective record-based cross-sectional study was conducted over a month in July 2022. Institutional Ethics Committee (IEC) approval was obtained prior to commencement of the study (GMCIEC/2022/88 dated 30/06/2022). Waiver of consent was obtained from IEC of Goa Medical College.

**Sampling technique**

Universal Sampling Technique was used to collect records of all 523 workers from food packaging industry in North Goa who are registered with an Occupational Health Service (OHS) Centre after necessary permissions ensuring the confidentiality and privacy of the data of the food packaging industry workers.

**Study participants**

Inclusion criteria- All workers working in the Food packaging industry for 5 years, registered with the OHS center and having complete records.

**Data collection**

The OHS Centre conducts periodic medical check-ups of these food packaging industry workers along with other industry workers and thus was a reliable source of epidemiological data on these industry workers. The data included socio-demographic details, presence of co-morbidities, anthropometry (height, weight, BMI), pulse, blood pressure measurements, routine blood investigations (haemoglobin, Random Blood Sugar Levels (RBSL), serum creatinine, blood group), vision tests, ECG, chest x-ray, urine microscopy, stool microscopy and audiometry readings.

**Data analysis**

Data was entered and analysed using Microsoft Excel. Descriptive statistics for continuous data with normal distribution were expressed as mean and standard deviation. Frequency distribution was estimated for categorical data and expressed in percentages. Chisquare test was used to find the association of categorical variables with BMI and all variables with $p \leq 0.05$ were considered statistically significant. Pearson's correlation was used to find the correlation between BMI and the continuous variables.

**Operational Guidelines**

***Sedentary worker***

Any waking behavior such as sitting or leaning with an energy expenditure of 1.5 metabolic equivalent task (MET) or less.[1]

***Hypertension***

History of hypertension or Systolic BP$\geq$130 mmHg and/or Diastolic BP$\geq$80mmHg according to the new American Heart Association guidelines.[4]

***Diabetes***

History of diabetes or fasting blood glucose $\geq$126 mg/dl and/or post prandial blood glucose $\geq$200 mg/dl according to the American Diabetes Association guidelines (2022).[5]

***Nutritional status***

Underweight (<18.5 kg/m$^2$), normal or lean BMI (18.5–22.9 kg/m$^2$), overweight (23.0–24.9 kg/m$^2$) and obese ($\geq$25 kg/m$^2$).[6]

***Audiometry***

Audiometry results were interpreted as follows based on WHO grades of hearing impairment. Hearing levels of 26-40 dB as mild, 41-60 dB as moderate, 61-80 dB as severe and >80 dB as profound hearing impairment.[7]

***Visual status***

Far vision was checked using Snellen's chart and Near vision using Roman text type and patients were classified as having Normal vision, Normal vision with correction and Uncorrected vision.

***Anaemia***

Normal haemoglobin- Women: 12.1 to 15.1 gm/dl; Men: 13.8 to 17.2 gm/dl.[8]

**Results:**

Among the records of 523 workers that were studied, the mean age of the workers was 33.12 years among which 472 (90.2%) were males and 51 (9.8%) were females. As mentioned in Table 1 only 17 (3.3%) workers were known hypertensives. A quarter i.e.127 (24.2%) workers had isolated systolic hypertension of which, 16 (3%) were known hypertensives and 36 (6.8%) of them had isolated diastolic hypertension of which only 7 (1.3%) were known hypertensives. Although, 7 (1.3%) were known diabetics, 11 (2.1%) were found to have RBSL more than 200mg/dl of which none of them were known diabetics. A small percentage i.e. 4 (0.8%) had both diabetes and hypertension.

From Table 1 it was observed that, the BMI of the workers ranged from 14.88kg/$m^2$ to 37.39 kg/$m^2$ with a mean of 23.01 kg/$m^2$. It was observed that15 (2.9%) workers had mild conductive deafness while 4 (0.8%) had moderate conductive deafness.

Visual acuity for far vision with Snellen's Chart showed that 42 (8%) workers had uncorrected defect while 38 (7.3%) had normal vision with correction. The study showed that 8.2% workers (42 males and 1 female) had a serum creatinine above the reference range (0.57-1.11 mg/dl). Majority, i.e. 514 (98.3%) individuals had normal ECG readings while 9 (1.7%) showed abnormal readings which needed further evaluation with treadmill test and 2D Echocardiography. Nearly16.9% of the workers were anaemic. However, in contrast to a small percentage of female workers with anaemia i.e. 24 (4.5%), more males were detected with anaemia i.e. 65 (12.4%).

As seen in Table 2, on bivariate analysis, variables such as age $\geq$30 years ($p$=0.000), presence of comorbidities ($p$=0.011), near vision ($p$=0.000), total vision ($p$=0.031) and blood pressure ($p$=0.002) were significantly associated with being overweight or obese. While variables such as sex, audiometry, color vision, far vision had no statistical significance with BMI.

From Table 3 it was observed that there were significant ($P$<0.01) positive correlations of BMI with both systolic and diastolic BP. It showed that BP increased with increase in BMI. Correlation coefficient showed that relationship of BMI with systolic BP (0.232) was stronger than diastolic BP (0.166). There was also significant positive correlation between age and BMI.

Other investigations e.g. chest x-ray, stool and urine routine and microscopy did not reveal any abnormality. All workers with abnormal findings were subjected to further evaluation and treatment.

**Table 1: Health Profile of Study Participants (N=523)**

| Health indicator | Frequency | Percentage (%) |
|---|---|---|
| Body Mass Index | | |
| Underweight | 53 | 10.1 |
| Normal | 218 | 41.6 |
| Overweight | 103 | 19.6 |
| Obese | 149 | 28.4 |
| Blood pressure | | |
| Normotensive | 343 | 65.5 |
| Hypertensive | 17 | 3.3 |
| Raised systolic BP | 127 | 24.2 |
| Raised Diastolic BP | 36 | 6.8 |
| Blood investigations | | |
| Anaemia | 89 | 17 |
| Diabetes (RBSL) | 11 | 2.1 |
| Raised serum Creatinine | 43 | 8.2 |
| ECG | | |
| Normal | 514 | 98.3 |
| Abnormal | 9 | 1.7 |
| Audiometry | | |
| No hearing impairment | 523 | 96.3 |
| Mild impairment | 15 | 2.9 |
| Moderate impairment | 4 | 0.8 |
| Severe impairment | 0 | 0 |
| Profound impairment | 0 | 0 |
| Far vision | | |
| Normal | 443 | 84.7 |
| Normal with correction | 42 | 8.0 |
| Uncorrected | 38 | 7.3 |
| Near vision | | |
| Normal | 460 | 88 |
| Normal with correction | 21 | 8.0 |
| Uncorrected | 42 | 4.0 |
| Colour vision | | |
| Normal | 510 | 97.5 |
| Defective | 13 | 2.4 |

**Table 2: Bivariate Analysis of Factors Associated with BMI (N=523)**

| Variable | BMI | | p value | Crude OR | 95% CI |
|---|---|---|---|---|---|
| | Overweight/Obese | Normal | | | |
| Age (years) | | | | | |
| ≥30 | 164 (58.8) | 115 (41.2) | 0.000 | 2.574 | 1.806-3.667 |
| <30 | 87 (35.7) | 157 (64.3) | | | |
| Gender | | | | | |
| Female | 30 (58.8) | 21 (41.2) | 0.103 | 1.622 | 0.903-2.916 |
| Male | 221 (46.8) | 251 (53.2) | | | |
| Comorbidities (Diabetes, Hypertension, Both) | | | | | |
| Present | 20 (71.4) | 08 (28.4) | 0.011 | 2.857 | 1.235-6.610 |
| Absent | 231 (46.7) | 264 (53.3) | | | |
| Color vision | | | | | |
| Defective | 08 (61.5) | 05 (38.5) | 0.322 | 1.758 | 0.567-5.447 |
| Normal | 243 (47.6) | 267 (52.4) | | | |
| Near vision | | | | | |
| Defective | 46 (71.9) | 18 (28.1) | 0.000 | 3.166 | 1.781-5.628 |
| Normal | 205 (44.7) | 254 (55.3) | | | |
| Far vision | | | | | |
| Defective | 39 (48.8) | 41 (51.2) | 0.883 | 1.036 | 0.644-1.669 |
| Normal | 212 (47.9) | 231 (52.1) | | | |
| Total vision | | | | | |
| Defective | 70 (56.5) | 54 (43.5) | 0.031 | 1.561 | 1.040-2.343 |
| Normal | 181 (45.4) | 218 (54.6) | | | |
| Blood pressure | | | | | |
| Raised | 187 (52.5) | 169 (47.5) | 0.002 | 1.781 | 1.224-2.591 |
| Normal | 64 (38.3) | 103 (61.7) | | | |
| Audiometry | | | | | |
| Abnormal | 09 (47.4) | 10 (52.6) | 0.956 | 0.974 | 0.389-2.439 |
| Normal | 242 (48.0) | 262 (52.0) | | | |

**Table 3: Correlation Matrix between BMI, Blood Pressure and Age (N=523)**

| Variables | BMI | Systolic BP | Diastolic BP | Age |
|---|---|---|---|---|
| BMI | 1.000 | 0.232* | 0.166* | 0.203* |
| Systolic BP | 0.232* | 1.000 | 0.610* | 0.322* |
| Diastolic BP | 0.166* | 0.610* | 1.000 | 0.236* |
| Age | 0.203* | 0.322* | 0.236* | 1.000 |

Correlation is significant at the *0.01 level (2-tailed)

**Discussion:**

It was observed that 3.3% of the workers were known to be hypertensive at the time of examination whereas 24.2% were diagnosed to be hypertensive during the study thus signifying the importance of periodic screening and health check-ups. 1.3% of the workers were known diabetics. The study conducted by Mhalshekar et alshowed the prevalence of hypertension to be 24% and diabetes to be 32.2%.[9] Similar findings were reported by Lokhande et al[10] in Mumbai whose study showed that 35% of the workers were hypertensive and 6% were diabetic.

The mean BMI of the study participants was 23.01±3.68kg/$m^2$,which is considered overweight for the Asian Indians.This value was lower that found by Kazi et al in their study which has reported the mean BMI of 26.8±4.8 kg/$m^2$.[11] In this study 8.2% workers had a serum creatinine above the above the reference range. This needs further evaluation, as no other obvious underlying etiology was found. Therefore, all causes of raised serum creatinine need to be ruled out.

Majority i.e. 504 (96.4%) of the workers did not have any hearing impairment however 15 (2.9%) and 4 (0.8%) had mild and moderate hearing impairment respectively. The findings of the study showed less hearing impairment than that reported in a study by Shivali et al.[12] 16.9% of the workers were anaemic which was significantly higher than that seen in the study by Kalyani et al[13] which revealed that 0.4% of the workers with anaemia.

There was a significant association between obesity/overweight and the presence of comorbidities among the participants, which was similar to the study performed by Liu et al[14] using eHealth records from the University of Wisconsin Hospital. Similar results were also seen in a study by Pantalone et al in USA.[15]

In a cross-sectional study that included 8,000 participants from the 1999 to 2008 National Health and Nutrition Examination Survey (NHANES), it was observed that myopia was positively associated with higher BMI which is similar to the findings in this study.[16] Noh et al in their study also found that obese subjects had a higher probability of having myopia compared to individuals with a normal weight.[17]

This study showed a significant positive correlation between BMI and SBP and DBP. This was similar to the findings of a study performed by Song et al in a study among 843 students at a Medical University.[18] Like the study done by Mungreiphy et al,[19] this study also showed a positive correlation between age and BMI.

Since this study is a retrospective record-based study, it relies on pre-existing records, there is a lack of control over the quality and consistency of the data. There may also have been differences in how data was recorded across the subjects.

**Conclusion**:

As per the findings in this study,almost half i.e. 252 (48.1%) of the workers from the food packaging industry were either overweight or obese. About one-third, 28 (5.3%) of the workers suffer from disorders related to or exacerbated by a sedentary lifestyle like diabetes, hypertension which are known to progress with prolonged periods of reduced physical activity as seen at their workplace. Some workers also had hearing and visual impairment which needs further evaluation and appropriate treatment to prevent reduced work efficiency. Raised blood pressure ($p$=0.002), increasing age ($p$=0.000) and presence of comorbidities ($p$=0.011), was significantly associated with a raised BMI.

**Recommendation:**

There is a need to create awareness regarding avoidance of prolonged inactivity and the importance of promoting regular physical activity to prevent these lifestyle disorders among the workers. Regular health check-ups to screen the workers at their workplaces will help in reducing the burden of these diseases. Inaddition, health education regarding nutritious diet, importance of compliance to medication, exercise, adequate rest and relaxation techniques should also be repeatedly reinforced.

**Declaration:**

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Conflicts of interest: Nil

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