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Assessment of Bacterial Contaminants and Nutritional Profiles of Mung Bean Sprouts (*Vigna radiate L*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Aerobic bacteria were found as contaminants in mung bean sprouts (*Vigna radiate L*). They are also well-known for their excellent nutritional value as well as their ease of digestion. They are rich in calories, total carbohydrates, dietary fiber, protein, macronutrients, and vitamins.
Aim: To evaluate bacterial isolates and parameters of nutritional content of native mung bean sprouts and finally to assess the antimicrobial susceptibility testing of bacterial isolates to decide which antimicrobial agent should be utilized against certain bacterial strains.
Methodology: Total viable bacterial isolates were enumerated by the spread plate method, and bacterial species were determined from the selected culture media with biochemical analysis. Antimicrobial susceptibility patterns were performed by the Kirby-Bauer Disk Diffusion Method and minimum inhibitory concentrations were measured using the VITEK®-2 Compact system. The nutritional composition of the sprouts was assessed using procedures suggested by the AOAC (Association of Official Analytical Chemists).

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Results: The contaminated bacterial levels were relatively lower and the higher level of total aerobic plate counts was 7.60 log10 CFU/g and 8.46 log10 CFU/g, respectively. In this study, 20 (40.8%) of mung bean sprout *bacteria were lactose fermenters, such as E. cloacae complex 9* (18.4%), *E. coli 8* (16.3%), *and K. pneumonie* 3 (6.1%), which fermented lactose to produce acidic environments that appeared as pink colonies, and 15 (30.6%) of non-lactose fermenters, namely *A. baumannii* 7 (14.43%) and *P. aeruginosa* 8 (16.3%), produced normally colorless colonies, but the rest of 14 (28.6%) were late lactose fomenters of *S. marcescens* grown in red-pigmented colonies in culture media. Thirteen commercially available antibiotics were used for antimicrobial susceptibility testing of bacterial isolates. Eighteen nutritional parameters were evaluated for both raw and dry sprouts.

Conclusion: Mung bean sprouts have numerous health benefits. Because of the high number of outbreaks associated with the presence of hazardous organisms, strict safety standards must be followed.

Keywords: Mung bean sprouts; bacterial contaminants; antibiotics susceptibility and nutritional profiles.

1. INTRODUCTION

Mung bean *(Vigna radiate L)* sprouts are a culinary vegetable made from mung beans that have been sprouted. They can be grown by planting sprouted beans in the shade and watering them until the hypocotyls appear. Mung bean sprouts are widely grown and consumed in East and Southeast Asia; and they are relatively simple to grow; requiring only a consistent supply of water [1]. Because of its adaptability and nutritious benefits; the mung bean plant; which belongs to the Fabaceae or legume family; has been grown since ancient times and is a mainstay of Asian cuisine. Mung bean sprouts are plump; silvery-white shoots with two little yellow leaves at one end that form after mung beans are germinated. Mung beans are one of the most common types of sprouted beans for culinary purposes. They are crunchy and slightly nutty in flavor; with high water content; and can be used cooked or raw [2].

The germs that most commonly cause food poisoning from bean sprouts are *Salmonella spp.* and *E. coli.* Other bacteria; including *S. marcescens; A. baumannii; K. pneumoniae; E. cloacae complex*; *P. aeruginosa; Bacillus cereus; Staphylococcus aureus*; and *Listeria monocytogenes;* have been reported to cause disease when sprouts are consumed.

Microbial surveys show that there are high populations of aerobic bacteria in sprouts [3].There are different incidences of *Salmonella spp.* or *E. coli* O157:H7 in sprouts. Mung bean sprouts (maskalai-Bengali name) are commonly consumed in Bangladesh. There is not much information on the quality of mung bean sprouts and other sprouts in this region. Therefore; the aim of the study was to determine the risks associated with different types of sprouts; especially bean sprouts; and to assess the nutritive values of domestically produced sprouts in Bangladesh.

2. MATERIALS AND METHODS

2.1 Sprouts Sample Seed Collection

Sprouting mung bean seeds are extremely straightforward and raw seeds that have not been chemically treated. We purchased seeds avoiding toasted or roasted and avoiding milled or cracked sprouting seeds. We collected different types of sprouting seeds from different retail seed vendors like Hydrophonic Shad Krishi seed vandar; Seed Bazar BD and BD Garden Seed; Dhaka; Bangladesh.

2.2 Sampling

A total of 31 batches of bean sprouts samples were produced in the laboratory by maintaining aseptic condition at room temperature from July 2020 to April 2021. At each batch; 10 gram of sprouts was taken in sterile stomacher bag and then added 90 ml of sterile distilled water. After that blended with blender for 1 minute until homogenized and mixed well. That is considered a stock sample for analysis.

2.3 Microbial Analysis of Bean Sprouts

10 g of the sprouts was suspended in 90 mL of distilled water and placed on a rotary shaker for

Fig. 1. Mung bean sprouts production

Fig. 2. Harvested Mung bean sprouts

Fig. 3. Dry sprouts for nutritional analysis

15 minutes. Ten-fold serial dilution was prepared and aliquots of 0.1 mL of the appropriate dilutions were spread on MacConkey agar and Chromogenic agar plates; the plates were incubated at 37^0C for 48 hours [4].

2.4 Viable Counts of Bacteria

Bacterial hazards were determined by spread plating of appropriate dilutions (10^5 and 10^6) of sprout homogenate (10 g sample in 90 ml of sterile distilled water) on Chromogenic agar MacConkey agar; Sorbitol SS agar and SDA agar (Biomaxima; Poland). The pathogens were counted after 24 hours of incubation at 35^0±2 C.

Viable bacteria counting formula:

$$\textit{STANDARD FORMULA} = \frac{\textit{Colony count on agar plate}}{\textit{Total dilution of tube X Amount plated}}$$

2.5 Identification of Bacterial Isolates

For identification of the bacterial pathogens; Gram's staining was done to characterize the bacteria pathogens and then certain biochemical tests were conducted for further identified the organisms.

2.6 In-vitro Antimicrobial Sensitivity Test

According to the CLSI guidelines (CLSI; 2015); the Kirby- Bauer disc diffusion methods were used to in-vitro antimicrobial susceptibility tests of all the pathogenic bacteria isolates. The commonly used antibiotics namely Amikacin (30µg); Cefepime (30µg); Ceftriaxone (30µg); Cefuroxime (30µg); Ciprofloxacin (5µg); Colistin (10µg); Gentamicin (10µg); Meropenum (10µg); Nalidix acid (30µg); Nitrofurantoin (300µg); Tigecycline (15µg); Cefoperazone/Sulbactum (75/30µg); and Trimethoprim/Sulfamethoxazole (25µg) were used to test the antibiotic susceptibility of bacterial isolates from mung bean sprouts. The suspected isolated bacterial colonies were taken in sterile PBS (phosphate buffered saline) water and then adjusted to 0.5 McFarland's turbidity standard. The bacterial suspension was spread onto Mueller–Hinton agar (Himedia; India) and then impregnated antibiotic discs (Himedia; India) were placed and incubated at 37^0 C for 24 hours. Around the discs; the antibiotic zones of inhibition conformed were estimated in diameter of millimeter (mm).The zone span was really scaled from the focal point of the anti-microbial plate as far as possible of the reasonable zone where microscopic organisms could be seen developing. The interpretation of antibiogram was measured in millimeter (mm) of diameters as sensitive; intermediate and resistant as per the producer's guidelines.

2.7 Minimum Inhibitory Concentration (MIC)

The MIC was done with the VITEK®-2 Compact system (BioMerieux; SA France).

2.8 Nutritional Value Assessment

Moreover; the nutritional composition evaluations of the sprouts were analyzed by using AOAC 2019 (Association of Official Analytical Chemists) recommended methods. Parameters of nutritional values were analyzed during the study period; such as protein; total fat; saturated fat; sodium; iron; manganese; magnesium; phosphorus; total carbohydrates and vitamins.

2.9 Statistical Data Analysis

Data obtained were analyzed using SPSS version 20 and Excel 2016. The percentage of frequencies was generated for categorical variables such as rate of isolation; type of bacteria; rate of antibiotic sensitivity; resistance; intermediate of the organisms.

3. RESULTS

A 31 (thirty one) number of sprouts production batches with 49 bacterial contaminates were analyzed by gold standard culture methods following by Online Bacteriological Analytical Manual; USFDA for detection; enumeration and identification of individual organisms (USFDA; 2001). The observations of the experiments conducted were discussed as below:

3.1 Total Viable Bacterial Count (TVBC) and *Morphological Characteristics of Bacterial Isolates*

List of TVBC**;** bacterial isolates; and morphological characteristics on different dehydrated culture media from mung bean sprouts **(Tables 1, 2 & 3)**.

Bacterial contaminants were isolated and identified through the standard biochemical parameters such as the catalase test; coagulase test; oxidase test; motility-indole urease test; citrate utilization test; and triple sugar iron test Table 5. Finally; all the suspected cultures were confirmed with the VITEK®-2 Compact automated ID/AST instrument (BioMerieux; France). The analyzed antibiotic susceptibility parameters are shown in **Figs. 9,10 and Table 6;** and the MIC of antibiotics is given in **Table 7.**

Table 1. Total viable bacterial count (TVBC) in CFU/g and Log CFU/g

Batch No.	Dilution factor	Quantity of plated (ml)	Number of colonies	Bacterial count per gram sample(CFU/g)	Log CFU/gm
1.	10^6	0.1	80	$8x10^7$	8.00
2.	10^6	0.1	40	$4x10^7$	7.60
3.	10^6	0.1	100	$1x10^8$	8.00
4.	10^6	0.1	130	$1.3x10^8$	8.11
5.	10^6	0.1	170	$1.7x10^8$	8.23
6.	10^6	0.1	70	$7x10^7$	7.84
7.	10^6	0.1	40	$4x10^7$	7.60
8.	10^6	0.1	290	$2.9x10^8$	8.46
9.	10^6	0.1	100	$1x10^8$	8.00
10.	10^6	0.1	60	$6x10^7$	7.77
11.	10^6	0.1	160	$1.6x10^8$	8.20
12.	10^6	0.1	60	$6x10^7$	7.77
13.	10^6	0.1	100	$1x10^8$	8.00
15.	10^6	0.1	90	$9x10^7$	7.95
16.	10^6	0.1	45	$4.5x10^7$	7.65
17.	10^6	0.1	95	$9.5x10^7$	7.97
18.	10^6	0.1	170	$1.7x10^8$	8.23
19.	10^6	0.1	65	$6.5x10^7$	7.81
20.	10^6	0.1	60	$6.0x10^7$	7.77
21.	10^6	0.1	180	$1.8x10^8$	8.25
22.	10^6	0.1	150	$1.5x10^8$	8.17
23.	10^6	0.1	290	$2.9x10^8$	8.46
24.	10^6	0.1	250	$2.5x10^8$	8.39
25.	10^6	0.1	210	$2.1x10^8$	8.32
26.	10^6	0.1	190	$1.9x10^8$	8.27
27.	10^6	0.1	120	$1.2x10^8$	8.07
28.	10^6	0.1	130	$1.3x10^8$	8.11
29.	10^6	0.1	140	$1.4x10^8$	8.14
30.	10^6	0.1	90	$9.0x10^7$	7.95
31.	10^6	0.1	95	$9.5x10^7$	7.97

Table 2. List of isolates bean sprouts on MacConkey Agar culture plates

SL	Bacterial profiles	Color	Bacterial colonies characteristics
1.	*Serratia marcescens*	Late lactose fermenter; Cream-white color	Flat; moist; non-mucoid colonies
2.	*Enterobacter cloacae complex*	Lactose fermenter; pink to red	Mucoid; moist; sticky and slimy but smaller than *Klebsiella* spp
3.	*Escherichia coli*	Lactose fermenter; red/pink	Flat; dry; pink; non-mucoid colonies
4.	*Klebsiella pneumoniae*	Lactose fermenter; pink	Mucoid; moist; sticky & slimy
5.	*Acinetobacter baumannii*	Non-Lactose Fermenter; Colorless	Transparent; round & dry
6.	*Pseudomonas aeruginosa*	Non-Lactose Fermenter; Colorless	Flat; smooth colonies; 2-3mm in diameter with greenish to brownish pigmentation.

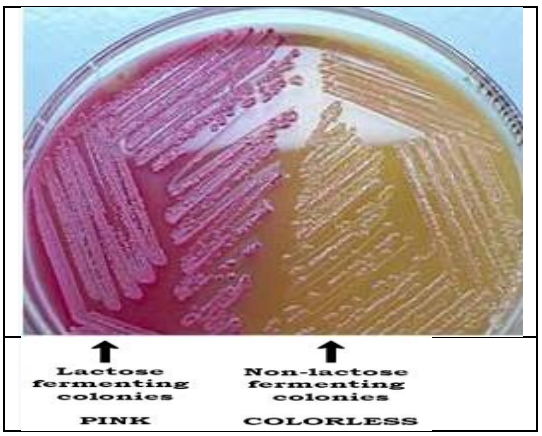

Fig. 4. Lactose and non lactose fermenting bacterial colonies from sprouts samples on MacConkey agar plate

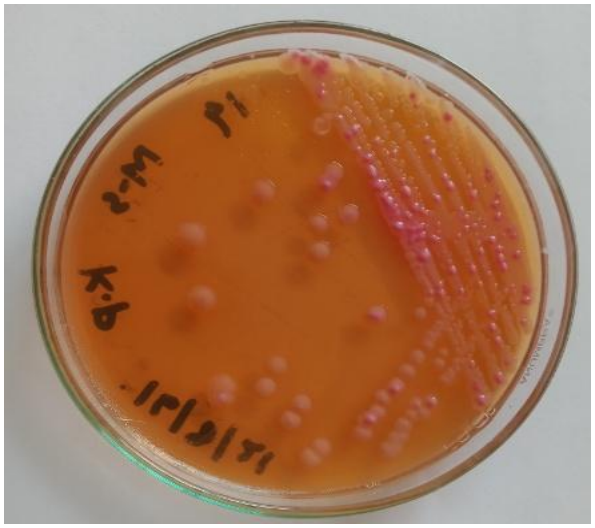

Fig. 5. *K. pneumoniae* cultural growth on MacConkey agar plate

Fig. 6. *E. cloacae complex* cultural growth on MacConkey agar plate

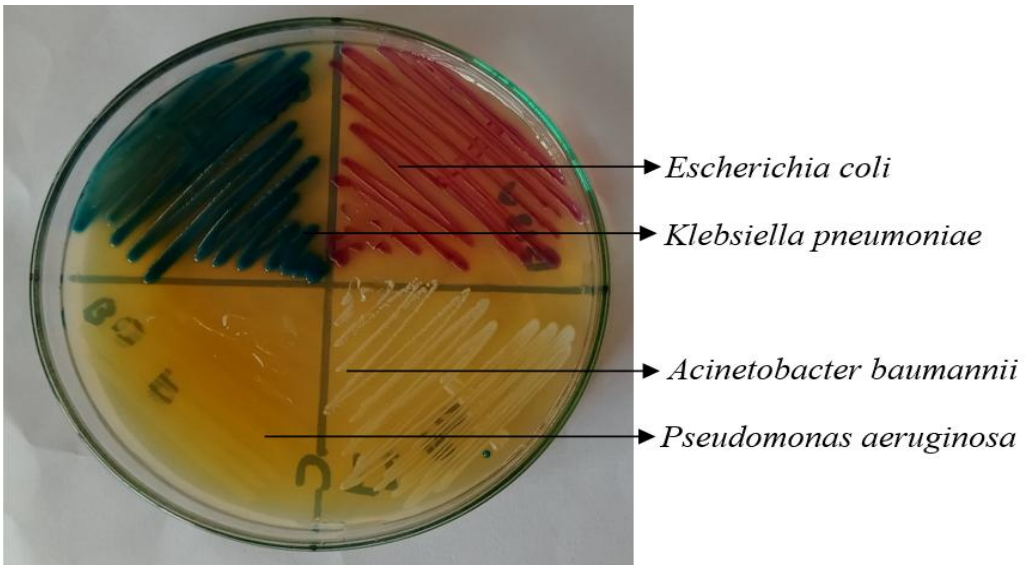

Fig. 7. Bacterial Profiles on Chromogenic agar plate

Table 3. List of isolates bean sprouts on Chromogenic Agar culture plates

Sl	Bacterial profiles	Color	Bacterial colonies characteristics
1.	*S. marcescens.*	Light blue	Flat; moist; non-mucoid colonies
2.	*E. cloacae complex*	Blue	Mucoid; moist; sticky and slimy but smaller than *Klebsiella* spp
3.	*E. coli*	Pink-purple	Flat; dry; pink; non-mucoid colonies
4.	*K. pneumoniae*	Deep blue to purple; mucoid	Mucoid; moist; sticky & slimy
5.	*A. baumannii*	Colorless	Transparent; round & dry
6.	*P. aeruginosa*	Colorless (greenish pigment may be observed)	Flat; smooth colonies; 2-3mm in diameter with greenish to brownish pigmentation.

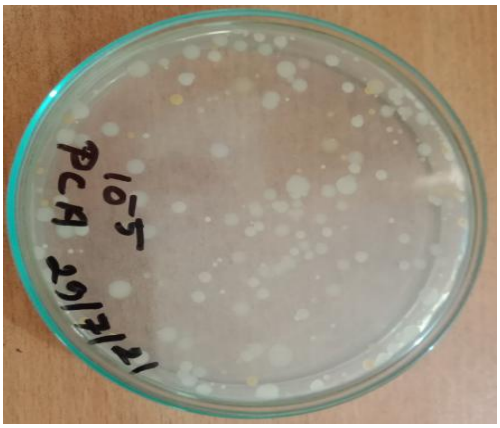

Fig. 8. Total aerobic bacterial count on Plate count agar medium (Countable; 30-300CFU/g)

4. DISCUSSION

The bacteriological status of mung bean sprouts is investigated in this study. It was discovered that the lower level of total aerobic plate counts was 7.60 log10 CFU/g and the high bacterial levels were 8.46 log10 CFU/g during the assessment of the bacterial quality of sprouts samples after five days of sprouting; similar to earlier studies [6].

In this study; the TVBC was 1.06x10^8 CFU/g in the dilution factor of 106; which is correlated with lacumin Lucilla; Ginaldi Federica et al. 2017 [7]. Bacterial populations of total aerobic bacteria (TAB); namely *E. coli* and *E. cloacae complex* on the sprouts; were also affected by purchasing sprouts from the market. Significantly; higher numbers of TAB (8.46 log10 CFU/g) were similar to those studies [8].

Table 4. Total bacterial profiles isolated from mung bean sprouts samples

SL. No.	Bacterial profiles	No. of isolates	Frequency (%)
1.	*S. marcescens*	14	28.6
2.	*E. cloacae complex*	9	18.4
3.	*P. aeruginosa*	8	16.3
4.	*E. coli*	8	16.3
5.	*A. baumannii*	7	14.3
6.	*K. pneumoniae*	3	6.1
Total		49	100.00

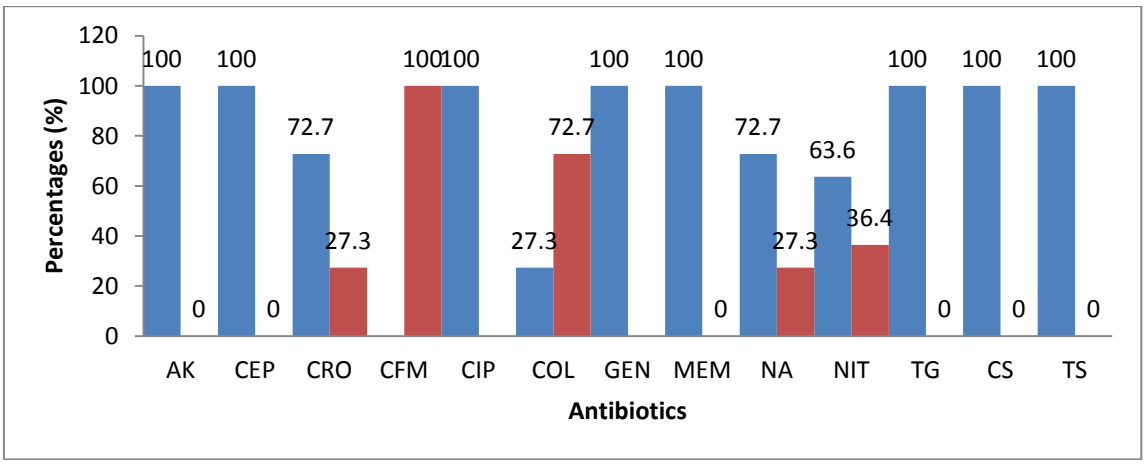

Fig. 9. Anti-biogram sensitivity and resistant pattern of *Serratia marcescens*

Note: *Amikacin (AK); Cefepime (CEP); Ceftriaxone (CRO); Cefuroxime (CFM); Ciprofloxacin (CIP); Colistin (COL); Gentamicin (GEN); Meropenum (MEM); Nalidix acid (NA); Nitrofurantoin (NIT); Tigecycline (TG); Cefoperazone/Sulbactum (CS); Trimethoprim/Sulfamethoxazole (TS)*

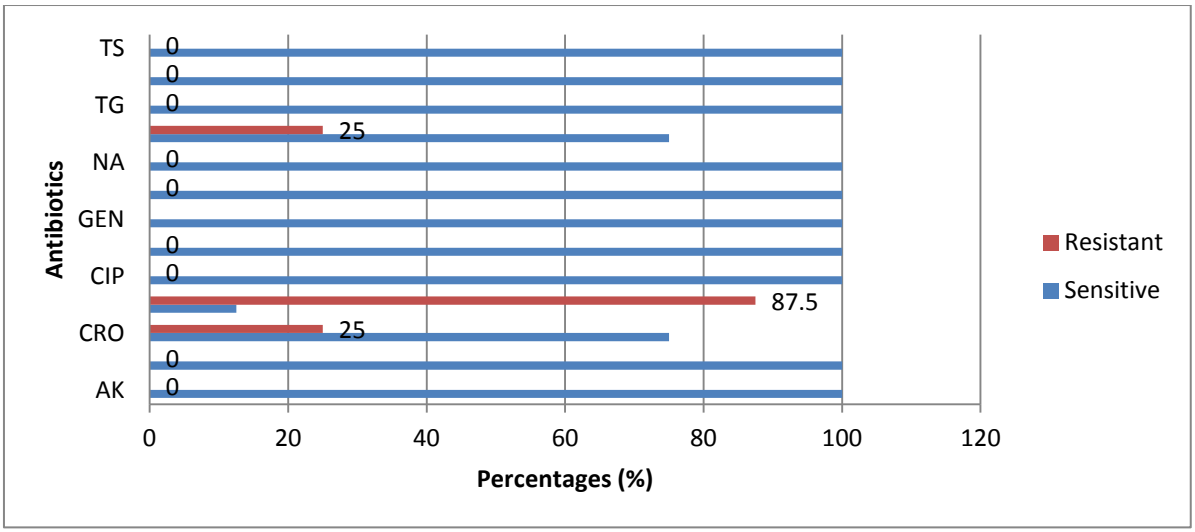

Fig. 10. Anti-biogram sensitivity and resistant pattern of *Enterobacter cloacae complex*

Table 5. Results of biochemical tests of the isolated bacterial species from sprouts samples

Bacterial hazards	Gram Reaction	KIA				MIU			Oxidase	S.citrate	Catalase
		Slant	Butt	Gas	H_2S	Mot	Indole	Urease			
S. marcescens.	G-Ve	R/Y	Y	±	-	+	-	±	-	+	+
E. cloacae complex	G-Ve	Y	Y	+	-	+	-	-	-	+	+
E. coli	G-Ve	Y[2]	Y	+2	-	+1	+3	-	-	-	+
K. pneumoniae	G-Ve	Y	Y	+	-	-	±	+	-	+	+
A. baumannii	G-Ve	R	Y	+	_	+		-	-	±	+
P. aeruginosa	G-Ve	R	R	-	-	+	-	±	+	+	+

Note: *KIA =Kligler's Iron Agar test; MIU=Motility indole urease test; (+) =Positive; (-) =Negative reaction; (±)=Variable; R=Red (Alkaline reaction); Y=Yellow (Acid reaction); W=Weak positive; H_2S=Hydrogen sulphide; 1-A few strains are non-motile; 2-A few strains produce red-pink stant; 3-Aminority strains give a negative result. Cat=Catalase test; Mot=Motility test*

Table 6. *In-vitro* antibiogram profile of Gram-negative bacterial isolates

Bacterial isolates	Patterns	Amikacin	Cefepime	Ceftriaxone	Cefuroxime	Ciprofloxacin	Colistin	Gentamicin	Meropenum	Nalidix acid	Nitrofurantoin	Tigecycline	Cefoperazone/ Sulbactum	Trimethoprim/ Sulfamethoxazole
E. coli (n=3)	S	100	100	100	66.67	100	100	100	100	100	100	100	100	100
	R	00	00	00	33.33	00	00	00	00	00	00	00	00	00
K. pneumonie (n=3)	S	100	100	100	66.67	100	100	100	100	100	66.67	100	100	100
	R	00	00	00	33.33	00	00	00	00	00	33.33	00	00	00
A. baumannii (n=3)	S	100	100	100	33.33	100	100	100	100	100	66.67	100	100	100
	R	00	00	00	66.67	00	00	00	00	00	33.33	00	00	00
P. aeruginosa (n=3)	S	100	100	66.66	33.33	100	100	100	100	100	100	100	100	100
	R	00	00	33.33	66.66	00	00	00	00	00	00	00	00	00

Note: S=Sensitive; R=Resistant

Table 7. Minimum inhibitory concentration of Gram-negative bacterial isolates

Antibiotics	Bacterial contaminates			
	S. marcescens (n=11)	***E. cloacae complex (n=8)***	***K. pneumoniae (n=3)***	***A.baumannii (n=3)***
Amikacin	<=2 mcg/ml	<=2 mcg/ml	<=2 mcg/ml	<=2 mcg/ml
Cefepime	<=1 mcg/ml	<=1 mcg/ml	<=1 mcg/ml	<=8 mcg/ml
Ceftriaxone	<=1 mcg/ml	<=1 mcg/ml	<=1 mcg/ml	<=16 mcg/ml
Cefuroxime	16 mcg/ml	4 mcg/ml	-	-
Ciprofloxacin	<=0.25mcg/ml	<=0.25mcg/ml	<=0.25mcg/ml	<=0.25mcg/ml
Colistin	>=16 mcg/ml	<=0.5 mcg/ml	<=0.5 mcg/ml	<=0.5 mcg/ml
Gentamicin	<=1 mcg/ml	<=1 mcg/ml	<=1 mcg/ml	<=1 mcg/ml
Meropenum	<=0.25mcg/ml	<=0.25mcg/ml	<=0.25mcg/ml	<=0.25 mcg/ml
Nalidix acid	4 mcg/ml	<=2 mcg/ml	<=4 mcg/ml	-
Nitrofurantoin	128 mcg/ml	<=32 mcg/ml	<=64 mcg/ml	-
Tigecycline	2 mcg/ml	<=1 mcg/ml	<=1 mcg/ml	<=0.5 mcg/ml
Cefoperazone/ Sulbactum	<=8 mcg/ml	<=8 mcg/ml	<=8 mcg/ml	<=8 mcg/ml
Trimethoprim/ Sulfamethoxazo	<=20 mcg/ml	<=20 mcg/ml	<= 20mcg/ml	<=20 mcg/ml

Table 8. Nutritional parameters of sprouts by AOAC 2019 recommended methods

SL	Parameters	Unit	Dry Sprouts	Raw sprouts
1.	Calories	kcal/100g	354.24	28.8
2.	Total Carbohydrate	%	54.84	2.73
3.	Dietary Fiber	%	14.5	4.1
4.	Sugar	%	13.6	7.5
5.	Protein	%	32.37	3.03
	Fat			
6.	Total Fat	%	0.6	0.64
7.	Saturated Fat	g/100g	< 0.005	< 0.005
8.	Trans Fat	g/100g	< 0.005	< 0.005
	Macronutrients:			
9.	Magnesium (Mg)	mg/kg	457.0	130.0
10.	Phosphorus (P)	%	0.22%	0.02
11.	Potassium (K)	mg/kg	6025.0	8218.0
	Micronutrients:			
12.	Copper (Cu)	mg/kg	< 0.2	< 0.2
13.	Manganese (Mn)	mg/kg	20.0	20.0
14.	Iron (Fe)	mg/kg	69.0	135.0
15.	Zine (Zn)	mg/kg	45.0	92.0
16.	Sodium (Na)	mg/kg	151.0	340.0
	Vitamins :			
17.	Vitamin-C (Ascorbic acid)	%		0.87
18.	Vit-B9 (Folic acid)	ppm	312	7.8

In this study; 20 (40.8%) of mung bean sprout's *bacteria were lactose fermenters (LF); such as E. cloacae complex* 9 (18.4%); *E. coli 8* (16.3%); *and K. pneumonie* 3 (6.1%); which fermented lactose to produce acidic environments that appeared as pink colonies; and 15 (30.6%) of non-lactose fermenters (NLF); namely *A. baumannii* 7 (14.43%) and *P. aeruginosa* 8 (16.3%) produced normally colourless colonies; but the rest of 14 (28.6%) were late lactose fomenters (LLF) of *S. marcescens* grown in red-pigmented colonies in culture media. **(Table 2 & Fig. 4).** According to epidemiological investigations; Park CE and Sanders DW also isolated microbial hazards of *K. pneumoniae* and other bacterial isolates of LF; LLF; and NLF from mung bean sprouts that resembled these studies [9;10].

On the chromogenic agar culture plates; bacteria produced multiple colors of colonies of bacteria. *S. marcescens; E. cloacae complex; E. coli; and K. pneumonie* showed light blue; blue; pink-purple; and deep blue to purple colonies; but *A. baumannii and P. aeruginosa* produced whitish and colorless colonies; respectively **(Fig. 7)**.

In this experiment; all the bacterial isolates were 49/49 (100%) sensitive to only three antibiotics; namely Ciprofloxacin; Levofloxacin; and Meropenem. *S. marcescens* bacterial isolates were 100% resistant to Cephradine and Cefixime; *Enterobacter cloacae complex* was 100% sensitive to Imipenem and Cefixime; *P. aeruginosa* was not 100% resistant to any antibiotic; A. boumanni was 100% resistant to Amoxycillin; and *K. pneumonie* was 100% resistant to Amoxycillin and Cefixime (Figs. 9, 10; Table 6).

The most frequent bacterial isolates of *S. marcescens* were shown to be highly sensitive (100%) to Cotrimoxazole; Ciprofloxacin; Levofloxacin; Meropenem; Gentamycin; Cefuroxime; and Cefepime. Nitrofurantoin (71.4%); Ceftriaxone (78.6%); and Colistin sulphate (85.7%) demonstrated moderate sensitivity (Fig.10). The second most frequent bacterial isolates of the *E. cloacae complex* were shown to be highly sensitive (100%) to Ciprofloxacin; Levofloxacin; Meropenem; Nalidixic acid; and moderate sensitive to Nitrofurantoin (66.7%); Cotrimoxazole (88.9%); Ceftriaxone (66.7%); Colistin sulphate (88.9%); and Cefepime (66.7%) (Fig. 10).

Pseudomonas aeruginosa was 100% sensitive to Ciprofloxacin; Levofloxacin; Imipenem; Meropenem; Gentamycin; Nalidixic acid; and Cefepime; and moderate sensitive to Nitrofurantoin (87.5%); Cotrimoxazole (87.5%); Ceftriaxone (75%); and Colistin sulfate (75%). *E. coli* was 100% sensitive to Cotrimoxazole; Ciprofloxacin; Levofloxacin; Imipenem; Nalidixic acid; and Colistin sulfate; and moderate sensitive to Nitrofurantoin (75%); Cephradine (87.5%); Ceftriaxone (87.5%); Meropenem (87.5%); Cefixime (75%); Gentamycin (87.5%); and Cefepime (87.5%). Bacterial isolates of *A. boumanni* were shown to be 100% sensitive to commonly used antibiotics; namely Cotrimoxazole; Ciprofloxacin; Levofloxacin; Ceftriaxone; Meropenem; Gentamycin; Nalidixic acid; Colistin sulphate; and Cefepime; but a few antibiotics were shown to be resistant; namely Amoxycillin (100%); and Cefuroxime (85.7%). Cotrimoxazole; Ciprofloxacin; Levofloxacin; Ceftriaxone; Meropenem; and Gentamycin were 100% sensitive to *K. pneumonie*; but a few antibiotics were moderately sensitive; including Nitrofurantoin (66.7%); Cefuroxime (66.7%); Nalidixic acid (66.7%); Colistin sulphate (66.7%); and Cefepime (66.7%). Only two antibiotics were shown to be 100% resistant to amoxycillin and cefixime **(Table 6)**.

In this investigation; we showed different minimum inhibitory concentrations (MIC) in different commercial antibiotics. The total 49 bacterial isolates namely *S. marcescens* (n=14; 28.6%); *E. cloacae complex* (n=9; 18.4%); *A. baumannii* (n=7; 14.3%); and *K. pneumonie* (n=3;6.1%) were represented as highly MIC of Meropenum (<=0.25mcg/ml); Ciprofloxacin (<=0.25mcg/ml); and Gentamicin (<=1 mcg/ml). The lowest MIC was found only in Nitrofurantoin that was 128 mcg/ml **(Table 7)**.

There were a variety of nutrients in sprouts; but the most common are folate; magnesium; phosphorus and vitamin C (ascorbic acid) and Vit-B9; which were found in abundance (folic acid). In fact; they have higher amounts of these nutrients than fully-grown versions of the same plants [11].

Sprouts were an amazing food known for their nutritional value. Seeds of grains or legumes are germinated to produce this superfood containing more than 28.8 kcal/100g and 354.24 kcal/100g of calories in raw sprouts and dry sprouts; respectively **(Table 8)**. This report was higher than other results [12]. Sprouts are filled with dietary fiber and packed with protein. This analysis were found 4.1% and 14.5% of the dietary fiber in raw and dried sprouts of mung bean and protein was 3.03% and 32.37% in raw and dried sprouts; respectively. Surprisingly; a large amount of macro and micronutrients were present in sprouts which would be essential to building up health.

5. CONCLUSION

Six types of bacterial isolates were isolated from several batches of sprouts grown on various culture media and were found to be responsible for sprouts contaminated with organisms. If eaten raw or semi-cooked; these microscopic species can cause foodborne disease. *A. baumannii; P. aeruginosa; K. pneumonie;* and *E. coli* isolates were entirely resistant to cefuroxime. The nutritional content of dry sprouts is higher than

raw sprouts. We can use it as an alternate source of nourishment to help us recover from malnutrition. We should attempt or make efforts to determine its eligibility for the development of various appealing food items from sprouts. Sprouts have a long list of health advantages. Because of the number of outbreaks linked to the presence of harmful organisms; proper safety requirements should be observed.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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