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Screening of Lactic Acid Bacteria Strains Isolated from Some Nigerian Fermented Foods for EPS Production

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Abstract: This study was embarked upon to obtain laboratory strains of lactic acid bacteria from some traditional fermented foods, with potential for the production of exopolysaccharides (EPSs), which is an important factor in assuring the proper consistency and texture of fermented food. One hundred and fifteen strains of Lactic Acid Bacteria (LAB) were isolated and characterized from some fermented dairy ("Nono", "Fura", Yogurt, "Wara") and non-dairy foods ("Ogi" and "Fufu"). Lactic acid bacteria species identified were L. *fermentum, L.casei, L.plantarum, L. brevis, L.cellobiosus, L. delbrueckii, L..coryniformis, L. coprophilus, L.gensenii, L. lechmanii* and *Leu paramesenteroides.* 103 LAB isolates were screened for their EPS producing activity. The investigation in the screening for EPS synthesis by LAB isolated from dairy and non dairy product showed that more than 50% of the studied *L.plantarum* strains are active producers of Exopolysaccharide while 40% of the studied *L.fermentum*, 50% of *L.delbrueckii*, *Leu. mesenteroides ssp dextranicum*, 20% of *Leu.mesenteroides ssp mesenteroides, Leu. gelidium*, 10% of *L.casei, L. cellobiosus, Leu. amelbiosum, Lact. plantarum, Lact. piscium* respectively are active producer of exopolysaccharides. *The L casei ssp pseudoplantarum, L.casei ssp tolerans, Leu. mesenteroides ssp hordinae, Leu. pseudoplantarum* Lact. raffinolactis, *Lact. lactis ssp cremoris* manifest poor production activity *while Lact. raftinolactis* and *Lact.gravieae* did not reveal any exopolysaccharides activity. Their EPS ranged between 01.00-196.0 mg l^{-1} respectively.

Key words: Lactic acid bacteria · EPS · Identification · species · fermented foods

INTRODUCTION

A variety of polysaccharides produced by plants (cellulose, pectin and starch), algae (agar, alginates and carrageen an) and bacteria (alginate, dextran, gellan, pullulan and xanthan gum) are commonly used as food additives for their gelling, stabilizing or thickening properties [1]. However, the use of polysaccharides excreted during the manufacture of food, such as yoghurt, might be attractive for the food industry and should constitute a new generation of food thickeners. To date, exopolysaccharides (EPSs) produced by Lactic Acid Bacteria (LAB) have received increasing interest mainly because of their GRAS (generally regarded as safe) status [1] and their rheological (LAB) properties in food to improve the texture of fermented products [2]. Some EPSs produced by LAB present potential health-beneficial properties, such as immune stimulation [3], anti-ulcer and cholesterol-lowering activities [4]. Lactic acid bacteria are found in the range of fermented foods, therefore much interest has been shown in their use since they could be considering "natural" products. Some LAB is capable of producing a range of EPS. Of those, which have been investigated for EPS production, the majority has been isolated from dairy products [5-11]. A lot of Lactic Acid Bacteria (LAB) that produce exopolysaccharide (EPS) are available from indigenously fermented foods but lack of a local central culture collection center could not bring out the quality, quantity and physiological characteristics of such organisms or their EPS. However, information on their biosynthesis and molecular organization and fermentation strategy is rather scarce and the kinetics of EPS formation is poorly described. Moreover, the production of EPS is low and often unstable and their downstream processing is difficult. This study was therefore, aimed at isolation and identification of LAB

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from some Nigeria fermented foods and to screen the isolate for their potential for EPS production.

MATERIALS AND METHODS

Collection of samples: The lactic acid bacteria isolates were obtained from fermented dairy products (Yoghurt, "Nunu", "Fura" "Fura da nono" and "wara") and non dairy traditionally prepared "fufu" from cassava and "ogi" made from white and yellow maize (*Zea mays*) and red guinea corn (*Sorghum bicolor)* collected from various locations in Nigeria. (Bodija market and Sabo in Ibadan, Oyo State, Oja Oba and Oke Ope market in Ilorin, Kwara State, Usmadan Fodio University, Sokoto, Sokoto State, Ariaria main market and new market in Aba, Abia State and Uyo main market in Uyo, Akwa Ibom State respectively). Samples were taken to the laboratory for microbiological analysis.

Isolation of lactic acid bacteria: Serial dilutions of homogenized "fufu" and "ogi", "Fura", "Nunu", "Fura da nunu", "Wara" and yoghurt samples in 0.1% peptone saline were used for microbial isolation on MRS agar [13] respectively. Plates were incubated at 24 h at 35°C for isolation of mesophilic LAB. Isolation methods were similar to those recommended by Van den Berg *et al*. [9]. The isolates were maintained on MRS agar plates (Oxoid No. CM361) containing 50 mg 1^{-1} of nystatin (Sigma, Australia) kept at 4°C under anaerobic conditions.

Culture identification: Gram staining, catalase activity, gas production from glucose, growth in NaCl 6.5% was determined according to methods for lactic acid bacteria [13].

The identification work was done according to the methods described in Bergey's Manual [15] and the Prokaryotes [16]. All the strains were maintained by weekly sub culturing from 48hrs MRS agar cultures. The cultures were examined microscopically by staining and morphological characteristics noted. Gram staining, catalase activity, oxidase test Gelatin hydrolysis were done using the method of Harigon and McCance [16]. Growth characteristics were monitored daily at 15°C, 30 and 45°C in tubes of MRS broth over 7days period. Salt tolerance was assessed after 3days of incubation at concentration of 40 and 65 g l^{-1} NaCl in MRS broth. Production of ammonia from arginine was done according to the method described by AbdEL-Malek and Gibson [17], Nitrate reduction was done as described by Gerhardt *et al*. [18].

Isolates were identified (genus and species) using the API 50 CH system (Bio-merieux, France). This identity kit works on the principle that each of the different types of carbohydrate fermentation patterns is unique to each bacterium and thus differentiates between them.

Screening of the isolates for EPS production: The identified isolates were screened for EPS producing activity by propagating them in ESM (Exopolysaccharides selection medium) used by van den Berg *et al*. [9] and labeled mESM. This medium contained 5% skim milk, 0.35% $^{w}/v$ yeast extract, 0.35% $^{w}/v$ peptone and 5% $^{w}/v$ glucose.

The isolates were transferred in MRS agar slants into 10 ml MRS broths and incubated for 24h at 30°C. A loopful of each of these cultures was transferred into 100 ml conical flasks containing 10ml of mESM broth and the broths were incubated anaerobically for 24h at 30°C. The 10 ml inocula were transferred into 200 ml conical flasks containing 90 ml of mESM broth and incubated at 30°C for 30h.

Samples were taken for analysis at the end of the fermentation period.

Measurement of growth: The optical density at 620 mm was used to monitor cell growth after appropriate dilution of samples.

Isolation, purification and quantification: The exopolysaccharides were isolated according to the method of Garcia-Garibay and Marshall [19]. The lactic acid culture was treated with 17% ($^{w}/v$) of 80% trichloroacetic acid solution and centrifuged at 16,000-x g at 4°Cfor 30min.The clarified supernatant was concentrated 5 times by evaporation using a rotavap evaporator. The exopolysaccharides were precipitated by adding 3 volumes of cold absolute ethanol and stored overnight at 4°C. Finally, the recovered precipitates were redissolved with distilled water and dialyzed against the same solution for 24h at 4°C. To remove residual lactose from the medium. The polysaccharides were freeze-dried and stored at 4°C. The total amount of carbohydrates in the polysaccharides was determined by the phenol-sulfuric acid method described by Dubois *et al*. [20]. The exopolysaccharides production was expressed as mg 1^{-1}.

RESULT AND DISCUSSION

A total of One hundred and thirteen lactic acid bacteria isolates were obtained from seven fermented foods (Wara'', "nono", "fura", "fura da nono", yoghurt, "fufu" and "ogi") in Nigeria. The isolates were initially differentiated on the basis of their cultural and cellular morphological studies after which they were subjected to various physiological and biochemical tests.

The isolates were Gram positive, rods, cocci, ovoid and produce no endospore. They showed moderate or scanty growth on MRS agar. The isolates were oxidase, catalase, gelatin, casein hydrolysis, Nitrate reduction, hydrogen sulphide and Voges Proskauer negative. Some strains hydrolysed starch and they were facultative anaerobes and were fermentative rather than being oxidative in nature. These were *L. fermentum, L.casei, L.plantarum, L.brevis, L.cellobiosus, L.delbrueckii, L.coryniformis, L.coprophilus, L.jensenii, L.leichmanii and Leu. pseudoplantarum, Lact. plantarum, Lacto. Raffinolactis and Lact.piscium*.

After the preliminary characterization test, 57 of them were found to belong to genus Lactococcus, 28 strains were determined to subspecies level and were identified as *L.casei ssp pseudoplantarum LCN4 and LCN5, L.casei ssp tolerant, L.coryniformis ssp coryniformis, L.coryniformis ssp tonquence, Leu. mesenteroides ssp mesenteroides, Leu. mesenteroides ssp cremoris, Leu. mesenteroides ssp dextranicum, Lact. lactis ssp cremoris, Lact. Hordinae and Lact.lactis ssp plantarum*. All the bacteria isolated from the fermented foods fit the classification of LAB as Gram-positive, catalase negative and oxidase negative [21]. Classification of the isolates led to identification of species.

The frequency of occurrence of lactic acid bacteria in the categorized fermented dairy and non-dairy food are shown in Table 1. The most predominant LAB species isolated was *Lactobacillus plantarum* followed by *Leu. mesenteroides ssp mesenteroides*. As in the earlier reports [22] on the occurrence of lactic acid bacteria spectrum, *L. plantarum* constituted the highest number of LAB isolated from fermented plant materials. The involvement of various types of LAB in fermented vegetables and plant materials had earlier been reported [23-25].

Thus LAB were present in fermenting foods, because of their ability to produce high levels of lactic acid as well as being able to survive under high acidic conditions. High percentage of *L.plantarum* recorded in this present study could be due to the fact that majority of the substrate used in the preparation of the fermented foods are of plant origin.

The identification of different types of LAB species in the present study could be due to the fact that majority of the substrate used in the preparation of the fermented

Table 1: Species and frequency of occurrence of lactic acid bacteria isolated from fermenteddairy and non-dairy food

Source	Lab strains	Freqency of occurrence (%)
White "Ogi"	*Lactobacillus plantarum*	30.8
	Leuconostoc mesenteroides subsp hordinae	8.0
	Leuconostoc gelidium	8.0
	Leuconostoc amellbiosum	8.0
	Lactobacillus delbrueckii	15.4
	Leuconostoc pseudomesenteroides	8.0
	Lactobacillus raffinolactis	8.0
	Lactobacillus helveticus	8.0
	Lactobacillus cellobiosus	8.0
Yellow "Ogi"	*Leuconostoc pseudomesenteroides*	20.0
	Lactobacillus plantarum	20.0
	Leuconostoc amellbiosum	20.0
	Lactobacillus sp	20.0
	Lactobacillus cellobiosus	20.0
Brow "Ogi"	*Lactobacillus lactis spp cremoris*	33.3
	Lactobacillus fermentum	33.3
	Lactobacillus plantarum	33.3
"Nono"	*Lactobacillus brevis*	5.3
	Lactobacillus plantarum	15.8
	Lactobacillus fermentum	5.3
	Lactobacillus casei	5.3
	Leuconostoc lactis	10.5
	Lactobacillus curvatus	5.3
	Lactobacillus piscium	15.8
	Leuconostoc mesenteriodes subsp mesenteroides	5.3
	Lactobacillus casei subsp pseudoplantarum	10.5
	Lactobacillus casei subsp tolerans	5.3
	Leuconostoc gelidium	10.5
	Lactobacillius fructovoran	5.3
Fura	*Lactobacillius coprophilus*	14.3
	Leuconostoc amellbiosum	28.5
	Lactococcus hordniae	14.3
	Lactobacillius helveticus	14.3
	Lactobacillius plantarum	14.3
	Leuconostoc mesenteroides subsp cremoris	14.3
"Fura da Nono"	*Lactobacillius plantarum*	25.0
	Leuconostoc mesenteroides subsp dextranicum	25.0
	Leuconostoc mesenteroides subsp cremoris	25.00
	Lactobacillius plantarum	25.00

Table 1: Continued

"Wara"	*Lactococcus garvieae*	6.25
	Lactococcus raffinolactis	6.25
	Leuconostoc mesenteroides subsp mesenteroides	6.25
	Leuconostoc mesenteroides	6.25
	Leuconostoc gelidium	12.50
	Lactococcus lactis subsp cremoris	6.25
	Leuconostoc pseudomesenteroides	6.25
	Lactobacillus coryniformis subsp coryniformis	6.25
	Lactobacillus cellobiosus	6.25
	Lactobacillus plantarum	6.25
	Lactobacillus casei	6.25
	Lactococcus hordniae	6.25
	Leuconostoc amellbiosum	6.25
	Lactococcus lactis ssp hordniae	6.25
	Lactococcus mesenteroides ssp. cremoris	6.25
Choice Milk Yogurt	*Lactobacillus sp*	20.00
	Lactobacillus brevis	20.00
	Lactobacillus sp	20.00
	Lactobacillus lactis subsp cremoris	20.00
	Lactobacillus desidiosus	20.00
Topson Yogurt	*Leuconostoc mesenteroides subsp mesenteroides*	16.7
	Lactobacillus sp	16.7
	Lactobacillus jensenii	16.7
	Lactobacillus coryniformis subsp torquens	16.7
	Leuconostoc mesenteroides subsp mesenteroides	16.7
	Leuconostoc mesenteroides ssp dextranicum	16.7
Peak Yogurt	*Lactobacillus vinduscens*	25.0
	Lactobacillus leichmanii	25.0
	Lactobacillus plantarum	25.0
	Lactobacillus lactis subsp plantrum	25.0
Sunmilk Yogurt	*Lactobacillus salvarius*	66.7
	Lactobacillus lactis subsp plantrum	33.3
Garden city Yogurt	*Leuconostoc lactis*	25.0
	Lactobacillus fermentum	25.0
	Lactobacillus plantarum	25.0
	Lactobacillus lactis ssp plantarum	25.0
Fanmilk Yogurt	*Lactobacillus fermentum*	25.0
	Lactococcus mesenteroides	25.0
	Leuconostoc amellbiosum	25.0
	Lactococcus mesenteroides ssp. mesenteroides	25.0
"Fufu"	*Lactobacillus plantarum*	64.3
	Lactobacillus casei ssp tolerans	7.1
	Lactobacillus casei	7.1
	Lactobacillus hilgardii	7.1
	Lactobacillus cellobiosus	7.1
	Lactobacillus fermentum	7.1

foods are of different plant and animal origins and each particular plant species provides a unique environment in terms of completing micro-organisms natural plant antagonists, type availability and concentration of substrate and various physical factors. These conditions allow for the development of epiphytic flora, from which arises a population and sequence of fermentation microorganisms when the plant materials harvested and prepared for fermentation.

One hundred and three isolates were screened for EPS producing activity. 191 isolates from the selected food samples showed EPS production; only two isolates did not produce EPS (Table 2). This was in contrast to studies reported by Van den Berg *et al*. [9]. In which only 30 strains out of 607 tested showed the ability to produce exopolysacchrides.

The investigation in the first stage of screening for EPS synthesis by LAB isolated from dairy and non dairy product showed that more than 64.29% of the studied *L. plantarum* strains are active producers of Exopolysaccharide while 42.85% of the studied *L. fermentum*, 50% of *L.delbrueckii*, *Leu. mesenteroides, L. casei ssp pseudoplantarum* and *L. lactis,* 100% of *L. casei ssp tolerans, L. brevis, L. coryniformis, Leu. mesenteroides ssp dextranicum and L. ssp,* 40% of *Leu. gelidium, L. cellobiosus*, 66.7% of Lact. lactis ssp plantarum and 2.57% of Leu. *amellbiosum* respectively are active (EPS above 40 mg l^{-1}) producer of exopolysaccharides, As shown in Table 2. The *Lact. lactis ssp cremoris, Lact. gravieae* and *Lact. plantarum* manifest poor (below 40 mg l^{-1}) production activity while *Lact. raftinolactis (ORWI)* and *Lact.gravieae(OGW2)* did not reveal any exopolysaccharides activity. These results agreed with results about EPS from LAB produced by other authors [4].

The EPS ranged between 0.10-185.2 mg l^{-1}. *L.plantarum (LPWO11)* strains isolated from white "ogi" had the highest while the strain isolated from "brown ogi" (LPBOI4) had the lowest EPS activity. Among the *L. fermentum* strains the EPS ranged between 5.3-141.5 mg l^{-1}. *L. fermentum (LFFN3)* isolated from yoghurt had the highest while the strain isolated from" Brown ogi" (LFY4) had the least.

Among the *L.casei* strains, the EPS ranged between 6.4-138.8 mg l^{-1} in which *L.casei ssp tolerans (LCN6)* isolated from "fufu" had the highest and *L.casei* (LCW2) isolated from "brown ogi" had the least. Two strains of L.brevis isolated from "nono" and yogurt produced reasonable quality of EPS. Among the *L.cellobiosus* strains the EPS ranges between 14.9-74.0 mg l^{-1} in which

Table 2: Production of exopolysaccharides by lactic acid bacteria isolate

	Lactic acid bacteria	Exopolysa -ccarides (Mg l^{-1})	Sources	Occurrence (%)
	Screening of Lab for Eps production			
1	*L.plantarum LPN1*	170.0	"Nono"	64.29
2	*L.plantarum LPN2*	17.0	"Nono"	64.29
3	*L.plantarum LPFN3*	144.9	"Furada nono"	64.29
4	*L.plantarum LPW4*	17.2	"Wara"	64.29
5	*L.plantarum LPF5*	62.2	"Fura"	64.29
6	*L.plantarum LPN6*	115.8	"Nono"	64.29
7	*L.plantarum LPW7*	5.0	"Wara"	64.29
8	*L.plantarum LPY8*	164.4	Yogurt	64.29
9	*L.plantarum LPY9*	98.0	Yogurt	64.29
10	*L.plantarum LPW010*	79.4	White "ogi"	64.29
11	*L.plantarum LPW011*	185.2	White "ogi"	64.29
12	*L.plantarum LPW012*	5.8	White "ogi"	64.29
13	*L.plantarum LPY013*	62.2	Yellow "ogi"	64.29
14	*L.plantarum LPB014*	1.0	Brown "ogi"	64.29
15	*L. fermentum LFNI*	17.0	"Fura da nono"	42.85
16	*L. fermentum LFN3*	86.9	Yogurt	42.85
17	*L. fermentum LFFN3*	41.0	Yogurt	42.85
18	*L. fermentum LFY4*	141.5	Yogurt	42.85
19	*L. fermentum LFY5*	05.3	Brown "ogi"	42.85
20	*L. fermentum LFB06*	175.0	Yogurt	42.85
21	*L. fermentum LFY7*	54.3	Fufu	42.85
22	*L. casei LCFU*	148.2	"Nono"	50.0
23	*L. casei LCN1*	55.5	"Wara"	50.0
24	*L. casei LCW2*	64.0	"Brown ogi"	50.0
25	*L. casei LCN3*	62.2	"Nono"	50.0
26	*L. casei ssp pseudoplantarum LCN4*	1.0	"Nono"	50.0
27	*L. casei ssp pseudoplantarum LCN5*	43.4	"Nono"	50.0
28	*L. casei ssp tolerans LCN6*	138.8	Fufu	50.0
29	*L. casei ssp tolerans LCF7*	43.4	Fufu	50.0
30	*L. brevis LBN1*	197.4	"Nono"	100.0
31	*L. brevis LBY2*	80.0	"Yogurt"	100.0
32	*L. cellobiosus LCEWI*	74.0	"Wara"	40.0
33	*L. cellobiosus LCEW2*	14.9	"Wara"	40.0
34	*L. cellobiosus LCE03*	17.3	"Ogi"	40.0
35	*L. cellobiosus LCEY04*	22.3	Yellow "ogi'	40.0
36	*L. cellobiosus LCEW5*	40.5	"Wara"	40.0
37	*L.delbrueckii LD01*	116.4	"ogi"	500.0
38	*L.delbrueckii LD02*	2.5	"ogi"	50.0
39	*L.coprohilus COFNI*	64.7	"Fura da nono"	100.0
40	*L. coryniformis ssp coryniformis LCOW1*	68.2	"Wara"	50.0
41	*L.coryniformis ssp torquens CYY2*	138.0	Yogurt	50.0

Table 2: Continued

42	*L.fructvorans FW*	29.0	"Wara"	0.0
43	*L.helveticus HF1*	50.1	"Fura"	50.0
44	*L.helveticus hN2*	12.7	"Nono"	50.0
45	*L.curvatus CY1*	36.6	Yogurt	0.0
46	*L.decidious DY1*	174.0	Yogurt	100.0
47	*L.jensenii JY1*	138.0	Yogurt	100.0
48	*L. vinducens VTI*	137.9	Yogurt	100.0
49	*L.leichmanii LY1*	123.5	Yogurt	100.0
50	*L.salvarius SY1*	167.9	Yogurt	100.0
51	*L.higardi. LHFU*	196.0	Fufu	100.0
52	*Leu. mesenteroides UMN1*	33.0	"Nono"	50.0
53	*Leu. mesenteroides ssp mesenteroides UMM2*	83.8	Yogurt	50.0
54	*Leu. mesenteroides ssp mesenteroides UMMY3*	35.9	Yogurt	50.0
55	*Leu. mesenteroides ssp mesenteroides UMMY4*	86.9	Yogurt	50.0
56	*Leu. mesenteroides ssp mesenteroides UMMY5*	118.2	Yogurt	50.0
57	*Leu. mesenteroides ssp mesenteroides UMMW6*	35.9	"Wara"	50.0
58	*Leu. mesenteroides ssp mesenteroides UMMN7*	47.8	"Nono"	50.0
59	*Leu. mesenteroides ssp mesenteroides UMMW8*	48.7	"Wara"	50.0
60	*Leu. mesenteroides ssp mesenteroides UMMW9*	32.8	"Wara"	50.0
61	*Leu. mesenteroides ssp mesenteroides UMMN10*	3.1	"Wara"	50.0
62	*Leu. mesenteroides ssp hordinae UMMHW10*	3.1	White"Ogi"	0.0
63	*Leu. mesenteroides ssp hordinae UMMHW011*	26.1	White"Ogi"	0.0
64	*Leu. mesenteroides ssp dextranicum UMMDFN12*	138.0	"Fura da nono"	100.0
65	*Leu. mesenteroides ssp dextranicum UMMDFN13*	138.0	"Fura da nono"	100.0
66	*Leu. mesenteroides ssp cremoris UMMC FN14*	16.3	"Fura da nono"	0.0
67	*Leu. mesenteroides ssp cremoris UMMC FN15*	18.3	"Fura da nono"	0.0
68	*Leu. gelidium UGW1*	26.5	"Wara"	40.0
69	*Leu. gelidium UGFN2*	26.8	"Fura da nono"	40.0
70	*Leu. gelidium UGFN3*	50.2	"Fura da nono"	40.0
71	*Leu. gelidium UGW4*	74.0	"Wara"	40.0
72	*Leu. gelidium UGW05*	6.6	White "ogi"	40.0
73	*Leu.pseudoplantarum UPW1*	35.2	"Wara"	33.0
74	*Leu.pseudoplantarum UP02*	13.7	"ogi"	33.0
75	*Leu.pseudoplantarumUPYO*	11.3	Brown "Ogi"	33.0

Table 2: Continued

76	*Leu.amellbiosum UAY 1*	165.3	Yogurt	28.57
77	*Leu.amellbiosum UAF 2*	20.7	"Fura"	28.57
78	*Leu.amellbiosum UAW03*	5.8	White "ogi"	28.57
79	*Leu.amellbiosum UAB04*	5.9	Brown "ogi"	28.57
80	*Leu.amellbiosum UABF5*	7.3	"Fura"	28.57
81	*Leu.lactis*	158.6	"Nono"	50.00
82	*Leu.lactis*	16.6	"Nono"	50.00
83	*Lact.plantarum L002*	5.2	"ogi"	0.00
84	*Lact.plantarum L003*	29.8	"ogi"	0.00
85	*Lact.raffinolactis ORWI*	0.00	"Wara"	0.00
86	*Lact. raffinolactis ORN2*	39.8	"ogi"	0.00
87	*Lact. piscium OPN1*	33.0	"Nono"	50.00
88	*Lact. piscium OPN2*	70.3	"Nono"	50.00
89	*Lact.lactis ssp cremoris OLCN1*	12.5	"Wara"	0.0
90	*Lact.lactis ssp cremoris OLCY2*	5.0	Yogurt	0.0
91	*Lact.lactis ssp cremoris OLCB03*	3.0	Brown "ogi"	0.0
92	*Lact. hordiniae OLHW4*	72.2	"Wara"	100.0
93	*Lact. hordiniae OLHW5*	63.3	"Wara"	100.0
94	*Lact. hordiniae OLHF6*	63.3	"Fura"	100.0
95	*Lact.lactis ssp plantarum OLPY7*	1.6	Yogurt	66.7
96	*Lact.lactis ssp plantarum OLPY8*	141.5	Yogurt	66.7
97	*Lact.lactis ssp plantarum OLPY9*	110.2	Yogurt	66.7
98	*Lact.sp OSFU*	16.0	"Fufu"	0.0
99	*Lact. gravieae OGWI*	1.5	"Wara"	0.0
100	*Lact. gravieae OGFN1*	0.0	"Wara"	0.0
101	*L.sp*	137.0	"Fufu"	100.0
102	*L.sp*	101.1	"Fufu"	100.0
103	*L.sp*	86.7	"Fufu"	100.0

strain isolated from wara (LCEW1) had the highest. The two *L.debrueckii strains* were isolated from "ogi" and their EPS ranged between 2.5-116.4 mg l^{-1} respectively. Among the 13 strains of *Leu.mesenteroides,* EPS produced ranged between 03.1-138.0 mg l^{-1}. *Leu. mesenteroides ssp mesenteroides* (UMMY5) isolated from yogurt had the highest while *Leu. mesenteroides ssp hordinae (UMMHW10)* isolated from wara had the lowest. Cultures shown to be the same isolated species did not show similar EPS production. For example, the four *L.plantarum* isolates produces EPS yields from 01.0-185.7 mg l^{-1}. Thus, the amount of EPS production differs between species and varied within a species (i.e. different strains of LAB). It may also be dependent upon growth medium, temperature, dissolve oxygen and other environmental factors [2, 4, 7, 8] The highest exoploysacchride producing isolate was a strain of *L.brevis* LBF6 isolate from "fufu".

But From this research work it was observed that mesophilic LAB isolated from dairy and non-dairy fermented foods has potential for EPS production.

Lactic acid bacteria play an important role in food fermentation, as the product obtained with their aid is characterized by hygienic safety, storage, stability and attractive sensory properties. Since starter cultures are blended emphatically for the desired characteristics of the final product, maintenance of the optimal strain balance throughout the fermentation process is important.

EPS in their natural environment are known to play a role in the protection of the microbial cell against phygocytosis, phage attack, antibiotics or toxic compounds, predation by protozoan, osmotic stress, adhesion to solid surfaces and in cellular recognition. In food industry, microbial EPS are used as thickeners or viscosifiers, stabilizing or emulsifying agents or texturizers [26]. The functional properties of exopolysacchrides are influenced by their primary structure [26].

Our results demonstrate the diversity of LAB in dairy and non-dairy fermented foods in Nigeria. The selected fermented foods contain several species of LAB, which were identifying physiologically and have potential for EPS production. These strains can be use as starter culture with predictable characteristics and contribute to the development of small scale and commercial production of fermented food with stable consistent quality.

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