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Evaluation of the Performance of Sweet Potato Infusion as a Medium for Culturing Yeasts

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Abstract: Studies were carried out on preparation of a medium from an infusion of sweet potato for culturing of yeasts from suitable suspensions of pure culture. Growth of yeasts on the sweet potato agar (SPA) was comparable and sometimes higher than those obtained on potato dextrose agar (PDA). Supplementary nutrients namely, 0.3% yeast extract, 2.0, 1.0 and 0.5% glucose did enhance the performance as a good substitute for imported yeast isolation media. The yeast species used as test organisms were *Candida albican, Geotrichum candidum, Rhodotorula sp., Saccharomyces cerevisiae* Baker's yeast and *Saccharomyces cerevisiae* Brewer's yeast.

Key words: Sweet potato, evaluation, yeasts

INTRODUCTION

From time immemorial, aqueous extracts or infusions of plant organs have been used as sources of nutrients in culture media. An extract with or without additional nutrient constitutes a liquid medium and can be made solid if agar is added before autoclaving and pouring into petridishes. Common examples are potato dextrose broth (PDB) and potato dextrose agar (PDA) which are routine fungal culture media.

Many synthesized and conventional culture media e.g, PDA, malt extract agar and Agar-agar are usually imported into Nigeria and paid for in hard foreign currency. This represents a big drain on the country's foreign exchange. Therefore, utilization of locally available plant material for culture media as a substitute is a matter of utmost necessity in Nigeria, particularly at this time of world-wide economic recession where millions of dollars are-spent annually on the importation of dehydrated culture media[1].

Sweet potato (*Ipomoea batata*) is one of the most efficient carbohydrate producing food crops in the tropics used as staple food for human consumption, animal feed and source of industrial flour, starch, syrup and alcohol [2]. It has been estimated that over 107 million metric tonnes of sweet potato was produced world-wide in 1980[3].

It is grown as a rainfed crop. The ability of the crop to perform well in all the ecological zones of the northern Nigeria is due to its drought tolerance capacity for a considerable long period[3].

MATERIALS AND METHODS

Preparation of sweet potato agar(SPA): Sweet potato agar was prepared from an infusion of sweet potato *(Ipomoea batata)* tubers. 10 g of peeled tubers were cut into small pieces and boiled in 200 mL distilled water until they became very soft. After filtering the extract through muslin cloth, the filtrate was made up to 500 mL with distilled water and agar (1.6% final concentration) was added to the filtrate. The filtrate was then divided into four batches, with each batch containing 100 mL. The batches were supplemented separately with 0.3% yeast extracts, 0.5, 1.0 and 2.0% glucose before autoclaving.

Each of the batches was further supplemented with a drop of lactic acid before pouring into plates.

Preparation of potato dextrose agar (PDA): Potato dextrose agar was prepared from an infusion of Irish potato *(solanum tuberosum)* tubers. A 10 g of peeled tubers were cut into small pieces and boiled in 200 mL distilled water until they become very soft. This was then filtered through the muslin cloth. The filtrate extract was made up to 500mL with distilled water. Glucose (2%) and agar (1.6%) were added and the suspension was boiled to dissolve the agar. The medium was autoclaved and 2-3 drops of lactic acid added before pouring into plates.

Yeast strains: The yeasts used in this study were *Candida albican, Saccharomyces cerevisiae* (Baker's yeast), *Saccharomyces. cerevisiae* (Brewer's yeast), *Geotrichum candidum* and *Rhodotorula* sp. Yeast cultures were obtained from the culture bank of Federal Institute of Industrial Research Oshodi Lagos, Nigeria. All the organisms were maintained on potato dextrose agar slants in the refrigerator.

Microbiological evaluation: Aqueous suspensions of cells were prepared from 24 h old pure cultures of the yeast strains. The suspensions were diluted serially in sterile water and 0.1 mL aliquots of suitable dilutions was dispensed into duplicate plates

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which were labelled and sterilized.

The sterilized SPA and PDA were poured on the plates by pour plate technique. All plates were incubated at room temperature for 144 h. Viable counts expressed in Colonies which developed on the SPA and PDA plates were counted. The total carboydrate was determined by anthrone method[4]. Moisture content was determined based on the principle of drying to constant weight[5]. Protein was determined by Keldahl method[6]. The procedure of AOAC[7] was used for the estimation of crude fat. Crude fibre was determined by the difference in subtraction of weight on paper due *to* the insoluble material.

RESULTS

The growth curves obtained when the suspension of pure cultures of yeasts were plated on sweet potato agar with different supplements and on potato dextrose agar for comparison are presented in Fig. 1 to 5. In all cases, growth obtained on SPA were comparable to those obtained on PDA. Yeast extract (YE) effect as supplement

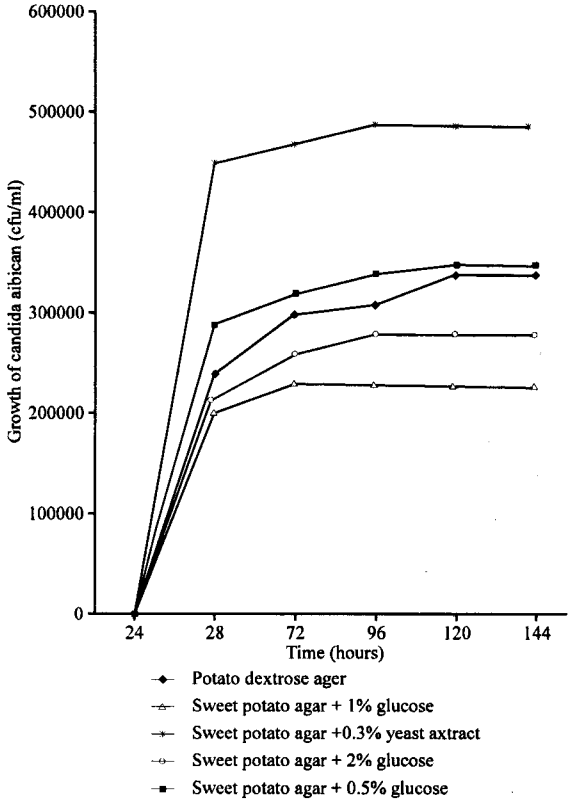

Fig. 1: Effect of potato dextrose agar, sweet potato dextrose + 2% glucose, sweet potato agar + 1% glucose, sweet potato agar + 0.5% glucose, sweet potato agar + 0.3% yeast extract on *Candida albican*

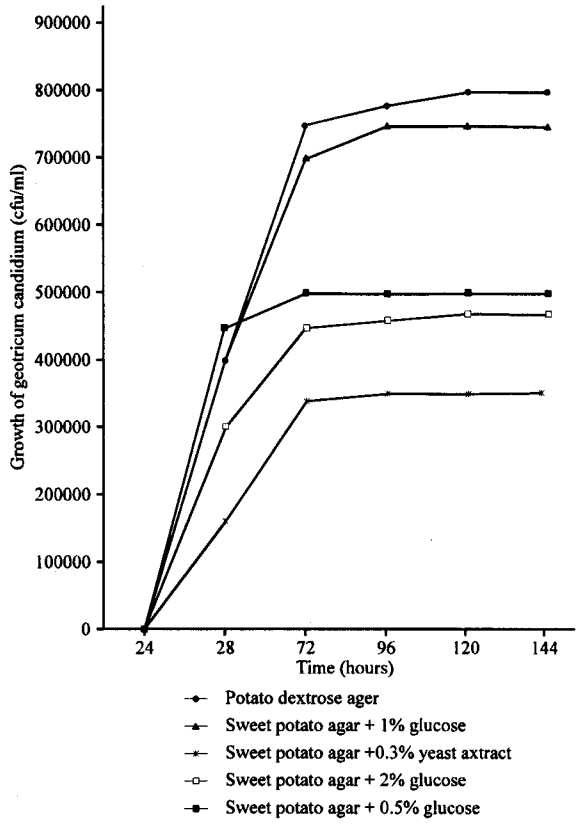

Fig. 2: Effect of potato dextrose agar, sweet potato dextrose + 2% glucose, sweet potato agar + 1% glucose, sweet potato agar + 0.5% glucose, sweet potato agar + 0.3% yeast extract on *Geotricum candidum*

was more effective in that it gave the highest growth in most of the yeast plated, also the yeast extract caused an increase in average colony size. The mean colony diameter in all the media was the same (average diameter was 1.5 mm) in both PDA and glucose supplemented SPA than those formed on yeast extract supplemented SPA (average diameter was 2.5 mm). In Fig. 1, *Candida albican* grew well on SPA with 0.3% (YE), the growth was far better than the growth on PDA. However the growth on SPA with 0.5% glucose was slightly higher than that on the PDA. The growth was least on SPA with 1% glucose. After 48 hours the growth was slightly up to 144 h. Figure 2 shows the growth of *Geotrichum candidum* on all the media used. It was observe that the growth was highest on PDA. The growth was rapid up to 12 h after which it was slightly. SPA with 1% glucose produced growth that was comparable to that on the PDA, the least growth occurred in SPA with 0.3% yeast extract but the growth

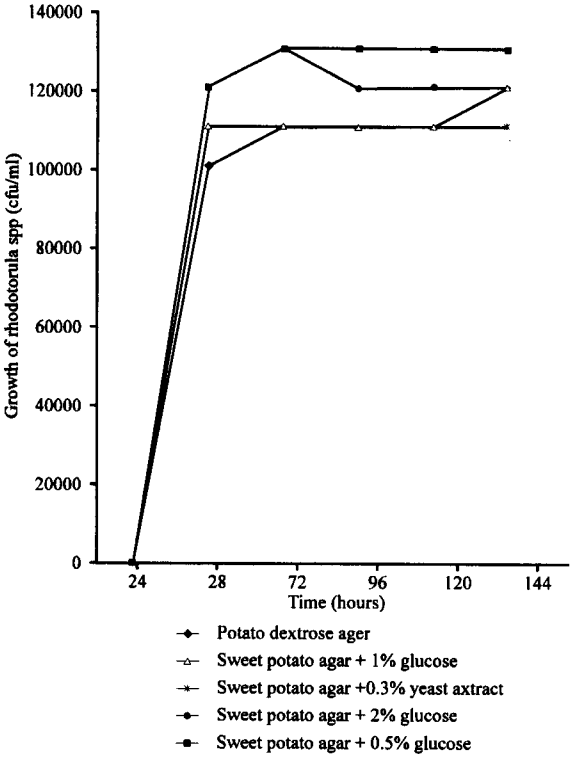

Fig. 3: Effect of potato dextrose agar, sweet potato dextrose + 2% glucose, sweet potato agar + 1% glucose, sweet potato agar + 0.5% glucose, sweet potato agar + 0.3% yeast extract on *Rhodotorula species*

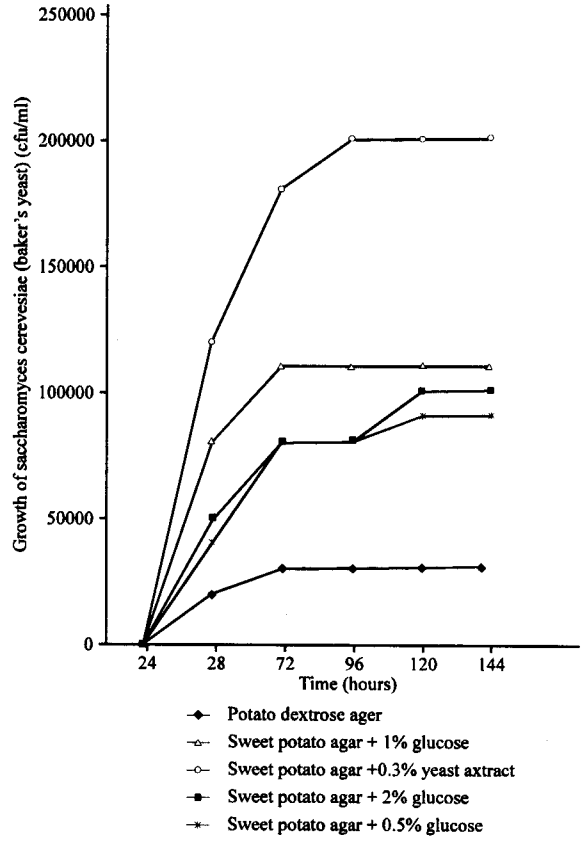

Fig. 4: Effect of potato dextrose agar, sweet potato dextrose + 2% glucose, sweet potato agar + 1% glucose, sweet potato agar + 0.5% glucose, sweet potato agar + 0.3% yeast extract on *Saccharomyces cerevesiae*

on all the media when compared was quite reasonable. The colony size in diameter was the same in all different media at 48 h but the colony size in SPA with yeast extract supplement was larger (average diameter was 3.0 mm).

The growth of *Rhodotorula* sp on all the media is presented in Fig. 3. Initial growth was generally low than when compared with the growth of *candida albican* and *Geotrichum candidum* even after longer incubation period.

The growth was highest in SPA with 0.5% glucose, followed by SPA with 2% glucose and SPA with 1% glucose, the least growth was on SPA with 0.3% yeast extract and PDA. Figure 4 and 5 showed that the SPA with 0.5, 1 and 2% glucose and 0.3% yeast extract were reasonably efficient when compared with PDA in recovering cells of each of the two strains of *Saccharomyces cerevisiae* from its pure aqueous suspension. The two strains were visually identical on each type of medium. The growth of both *Saccharomyces* strains i.e. baker's yeast and brewer's yeast were most out

Table 1: Chemical constituents (%) of raw sweet potato and irish potato

Constituent	Sweet Potato	Irish Potato
Moisture	64.791	79.075
Crude Protein	4.65	10.985
Ash	4.779	3.755
Lipid	1.573	2.953
Crude Fibre	3.645	1.320
Carbohydrate	20.562	1.912

standing in the SPA with 0.3% yeast extract. Their growth on SPA with 1 and 0.5% glucose were with a slight difference with their least growth occurring on PDA. Table 1 indicates the chemical composition of raw sweet potato and Irish potato. The protein and lipid content of Irish potato was higher, while sweet potato had a higher carbohydrate; reducing sugar and ash content.

DISCUSSION

The main aim of this study is to show that an agar medium prepared with an infusion of sweet potato tuber

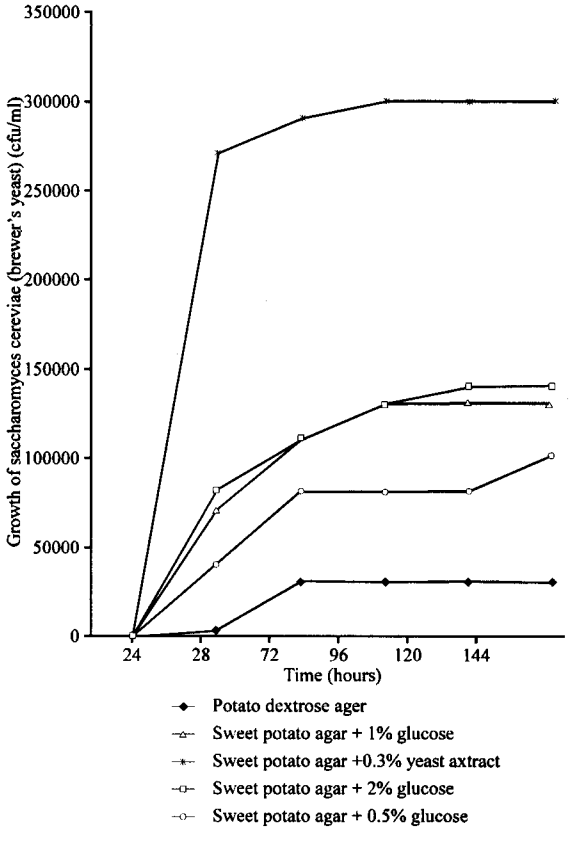

Fig. 5: Effect of potato dextrose agar, sweet potato dextrose + 2% glucose, sweet potato agar + 1% glucose, sweet potato agar + 0.5% glucose, sweet potato agar + 0.3% yeast extract on *Saccharomyces cerevisiae*

plant is suitable for culturing yeasts.

The organisms used were namely *candida albican, Geotrichum candidum Rhodotorula sp.*, two different strains of *Saccharmyces cerevisiae* i.e. baker's yeast and brewer's yeast. The medium has been called sweet potato agar (SPA) and has been shown to be comparable to PDA (a conventional medium) in culturing of yeasts. The performance of SPA medium with yeast extract supplement was seen to be better than the commercially prepared media, as was observed with *Saccharomyces cerevisiae* strains which had the best growth on SPA with yeast extract also SPA with different concentration of glucose supplements varied in performance with different yeast species as shown in Fig. 1 to 5.

Generally all formulated media performed very well in supporting yeast growth when compared with the conventional medium. Hence the use of alternative formulation had formed the basis of replacing the commercially produced culture media[8]. Result from the analysis of raw sweet potato and Irish potato (Table 1) showed that although the latter of better nutritional value the former is equally good nutritionally. Supplementary nutrients are therefore necessary for SPA to perform favourably well and even better than PDA as reported in some of the results in this study. The sweet potato from which SPA is prepared can be packaged in dry powdery form taken over long distance and kept at ambient temperature for long period without quality loss. Also, low cost of production, high yielding ability and availability are the economic advantages had over the use of imported potato dextrose agar and are paid for in hard currency. However, like the common media, it must be supplemented with antibiotics in order to inhibit bacteria growth.

The findings in this present study clearly revealed that sweet potato agar could be used to produce alternative culture media for culturing yeast to imported conventional culture media such as PDA. This new observation can both be applicable in modern laboratory as well as class practical whenever the commercially produced one is not available. Further work is needed to perfect the use of these local formulated media as substitute for culturing yeasts.

CONCLUSION

In conclusion, sweet potato agar is as good as other conventional agar for cultivation of yeast. In countries like Nigeria and other African countries which produce sweet potation abundance, the utilization of sweet potato agar for culture media is promising.

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