

Fig. 22 A toast to King Sargon. Assyria 2000 B.C.
(Ancient nutritional evaluation of beverages)



Fig. 23. The Gout (Ancient imagination of influence on metabolism).

It can be seen that the different beverages analysed are considerably variable with regard to protein, amino acid and nutrient compositions. This variability indicated that these beverages may be of different nutritional value when consumed on a regular basis. The growth of rats fed beer diets was not significantly different from that of control animals (Table 2). The wine-supplemented diet appeared to stimulate growth during the experimental period (Table 3).

Serum urea was significantly lower in animals fed the dry white and dry red wine diets, indicating a beneficial effect of these wine diets on protein catabolism. Since alkaline phosphatase is an indication of vitamin D status the results of lowering in all groups fed beverage supplemented diets, point to a beneficial effect of beverages on bone metabolism and structure (vitamin D metabolism).

Considerably elevated serum amylase is used as an indication of pancreatic related disorders. While the wine diets result in depressed diminished amylase activity, the reduction is not large enough to indicate a protective effect on the pancreas. Accordingly, it is more effective to establish whether digestibility and nutritional quality correlate with trypsin inhibitor levels and whether trypsin inhibitors in beverages and raw materials induce pancreatic changes similar to those observed when rats were fed trypsin inhibitors from soybeans. Consumption of wine had very little effect on the mineral balance in the experimental animals (Table 4).

SDS electrophoretic patterns of albumin and globulin subunits from whole serum of rats fed the beer samples with different enzymes revealed very slight differences (Fig. 21) and showed some major bands in the range of MW's — 17.0 - 141.0 kD and for wines — 14.0 - 153.0 kD. The serum proteins from the rats fed the different wine and beer samples were similar to normal serum.

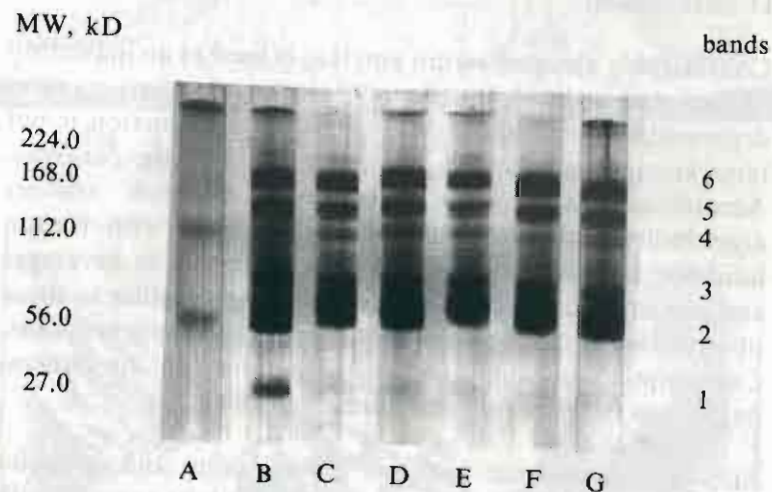
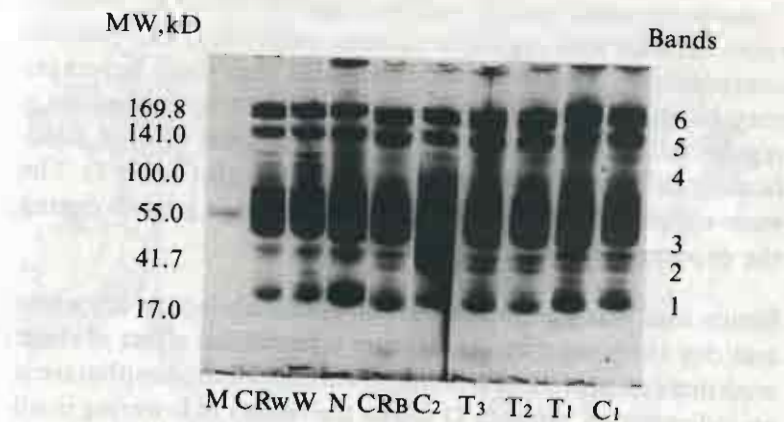


Fig. 24 SDS-PAGE in 5% (p) AAG at pH 7.0 of rat serum proteins ($5\mu\text{g}$ protein) from the following samples:
 (a) M, CR_w, W, N, CR_B, C₂, T₃, T₂, T₁, C₁ — respectively molecular marker; rat control for wines normal; rat control for beer; control II; test III; test II; test I and control I.
 (b) A, B, C, D, E, F, G, respectively molecular marker, normal, semi-sweet white, dry red, low alcohol dry white, dry white and control.

The caloric content of wines and beers is of interest to the wineries and breweries as it is one of the factors that can be altered by the choice of cultivar (grapes or cereals) and the fermentation process. However, the caloric content of the different wines and beers studied varied significantly, this factor had no apparent effect on the overall metabolism of the experimental animals as determined by the various physiological parameters measured in this study.

Chemical scores were calculated from the amino acid data and compared to recommended patterns for children and adults.

IV CONCLUSION

Recent techniques presently used for purification, fractionation, characterization and nutritional evaluation of proteins in cereals, other plants, enzymes and beverages were summarized with particular emphasis on storage proteins (prolamins, hordeins or zeins). Among the preparative techniques used are SDS-GF; SDS-PAGE in slabs and PAGIF in density gradients.

The analytical techniques include SDS-PAGE, PAGIF, PoroPAGE, Mapping. Methods for protein extraction, nitrogen content determination, modification, identification and enzymatic action were also described. Functional properties of proteins in beverages such as solubility, viscosity, emulsifying capacity and electrophoretic mobility were compared as well as the essential amino acid profiles during fermentation and post-fermentation periods following enzymatic action.

Protein composition can be used as a characterisation index or as criteria of cereals. With the use of appropriate cereals it is possible to modify the protein content in beverages and

improve the stability and nutritional values and hence the quality of the final product.

Incorporation of genes governing lysine concentration into agronomically acceptable cereals could have a significant effect on their nutritional and economic value. Most of the world's staples have a low lysine content. Thus, all these methods will probably receive wide use from researchers involved with world hunger and nutrition problems. The nutritional improvement of cereals should lead to an overall improvement of the world's nutrition situation (165).

In view of the world-wide protein malnutrition problem, improvement of food and feed quality is a major challenge to the scientific community.

I wish to express my great appreciation to the Council of the University of Zululand for the privilege they have accorded me in appointing me to a Chair in Chemistry. I value my association with this institution.

To the students, I would like to say how grateful I am for the opportunity I have to impart my knowledge.

I trust that this inaugural lecture will give an indication of my approach to the subject ("The trouble with chemists is that chemistry is too difficult for them" Albert Einstein) and the rigour and diligence with which all research must be undertaken.

Thank you.

The enzymes employed for different biochemical reactions in text, figures and Tables are:

α -amylases: Termamyl 60L (Novo-Industria/s); Convertases 70SC and SA (Schwarz) for the liquefaction of adjuncts, Fungamyl 800L (Novo-Industria/s) for the hydrolysis of starch and dextrin to fermentable sugars; β -glucanase + α -amylase: Cereflo 200L (Novo-Industria/s) for splitting β -glucan in malt; proteinases: Neutrase 0.5L (Novo-Industria/s) for breakdown of proteins to peptides.

The following are the compositions of the beer samples for this study:

- Control I = 65% malt + 35% sorghum
- Control II = 100% malt
- Test I = 50% malt + 50% sorghum + 0.1% Convertase 70 SC + 0.05% Convertase BGA
- Test II = 50% malt + 50% sorghum + 0.1% Convertase SA + 0.05% Convertase BGA
- Test III = 50% malt + 50% sorghum + 0.1% Termamyl 60L + 0.25% Cereflo 200L + 0.1 Neutrase 0.5L + 0.3g Fungamyl 800L/hL of wort.

Rats were fed in 2 separate groups, therefore it appears in samples of Control 1 and Control 2. These Control animals were given a wine-free or beer-free diet. Experimental rats were fed purified diets supplemented with wines and beers. Normal rat serum was taken from the serum bank as a standard for comparison of results received during the experiments.

TABLE 1: Procedure employed in the sequential extraction of proteins from defatted whole maize meals.

Fraction	Solvent	Temp. °C	Agitation time, h	Solvents used by Landry-Moureaux
LM-I	0.5 M-NaCl (not examined further)	4	1	
LM-II	Isopropanol, 70% + Na acetate, 0.5%	60 20	1 2	Isopropanol, 55% in absence of salts
LM-III	Isopropanol, 70% + 2-ME, 0.6%	20	1	Isopropanol, 55% + 2-ME, 0.6%
LM-IV	Na bicarbonate buffer, pH 10 + 2-ME, 0.6%	20	1	Borate buffer, pH 10 + 2-ME, 0.6%
LM-V	As for LM-IV + SDS, 0.5%	20	1	Borate buffer, pH 10 + 2-ME, 0.6% + SDS, 0.5%

TABLE 2: Body weight gains and food consumption of rats fed different types of beer

	Control for Rats	Types of Beer				
		Control I	Control II	Test I Test II Test III		
Food Consumption, (g)	354.4	339.2	351.5	335.3	381.0	354.4
Weight gain, (g)	95.4	72.8*	100.7	66.6*	98.3	98.1

* p < 0.01

TABLE 3: Food consumption and body weight gain of rats fed different types of wine

	(Control (1))	Low Alcohol		Semi-sweet		
		Dry White	White	(Control (2))	White	
Food consumption (g)	357.6	405.4	366.1	345.7	372.2	357.3
Weight gain (g)	98.0	112.8*	106.6	87.5	90.2	100.4**

*p < 0.01

**p < 0.05

Component	Normal	Control (1)	Dry White	Low Alcohol Dry White	Control (2)	Dry Red	Semi-sweet White
Total protein, g/L	65.0	62.6	61.5	60.6	64.2	59.5	61.3
Albumin, g/L	35.2	34.8	34.2	34.6	36.3	34.0	34.5
Globulin, g/L	32.3	28.5	27.3	26.0	30.2	28.0	28.5
Urea, m mol/L	5.5	5.3	4.4	5.2	5.45	5.4	5.25
Alkaline phosphatase, lu/L	196.0	180.2	161.5	147.8	185.7	171.5	163.3
Amylase, lu/L	6487.0	6837.0	6270.0	5818.0	6522.0	6214.0	6492.0
Minerals, mg/100 ml							
Ca	220.0	170.0	160.0	180.0	260.0	200.0	210.0
Mg	14.5	14.7	14.2	14.5	14.8	14.5	14.6
Fe	3.2	3.1	3.2	3.0	3.1	3.3	3.0
Zn	160.0	151.0	155.0	155.0	165.0	157.0	147.0
Cu	107.0	98.0	95.0	101.0	96.0	93.0	97.0

V ABBREVIATIONS AND DEFINITIONS USED

(P)AA	= (Poly) Acrylamide
Bis	= N,N'-Methylene-bis-AA
GE	= Gel electrophoresis
PAGE	= Polyacrylamide- GE
PoroPAGE	= Porosity gradient - PAGE
SDS or NaDodSO ₄	= Sodium dodecyl-sulphate
SDS-PAGE or NaDodSO ₄ -PAGE	= Sodium dodecyl sulphate Polyacrylamide Gel Electrophoresis
Protomer	= Protein monomer (subunit)
SDS-Protein	= Protomer with SDS
GF	= Gel Filtration
1-D	= unidimensional GE
2-D	= two-dimensional GE
Mapping	= PAGIF and PAGE, PoroPAGE or SDS-PAGE as 2-D procedure
PAGGE	= PAA/ Agarose - GE
SGE	= Starch GE
kD	= Kilo-Dalton, unit x 10 ³ of apparent MW
MW	= Molecular Weight (apparent)
ME	= Mercaptoethan-2-ol
Tris	= Tris (hydroxymethyl) aminomethane
EDTA	= Ethylenediaminetetraacetic acid. Di-sodium salt
TCA	= trichloroacetic acid
IP	= Isoelectric point
GC-MS	= Gas chromatography-mass-spectrometry
UF	= Ultrafiltration
CBB	= Coomassie Brilliant Blue
HPLC	= High Performance Liquid Chromatography
LM	= Landry and Moureaux
HFB	= Heptafluorobutyryl
HFBA	= Heptafluorobutyric anhydride
AGPA	= L - α -amino-β-guanidino propionic acid.

VI COMMENT ON THE FIGURES AND TABLES

All separations in slabs were done in the LKB Multiphor 2117 apparatus with an LKB 21105 power supply.

Gel thickness was 2 or 3 mm for PAGE. For PAGIF the gels were 0.1 mm thick on plastic support MW — markers for SDS-PAGE are 14.3; 42.9; 57.2; 71.5 and 85.0 kD for 10% PAAG and 56.0; 112.0; 168.0; 224.0; 280.0 and 335.0 kD for 5% PAAG.

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