

# NUTRIENT VALUE OF DIFFERENT TYPES OF WINE

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Recent advances in the understanding of the role of the various nutrients which form part of human and animal diets has led to an appreciation of the tremendous importance of each of these nutrients in maintaining health and preventing disease.

Nitrogen and mineral constituents play a role in stability of wines and, of course, in nutrition. However, knowledge concerning the nutritional and metabolic influence of beverages such as wine is one of the main problems of interrelationships of alcoholic beverages and nutrition. There are implications in the literature that wines, unlike certain other beverages, may be nutritionally beneficial.

Since wine forms part of the diet of many people it is essential to understand the influence of the caloric content of different types of wine since these beverages can form an important part of the body's energy supply. In addition, it is important to determine the effect on metabolism of different nutrients present in wine, such as, proteins, sugars, vitamins and minerals, since the quantities of these compounds can be varied during the production process and hence improve the nutritional value of the final product. Knowledge of the amino acid balance in this beverage is also essential since additions of small amounts of amino acids may have very significant effects on the nutrient value of wine.

In this study, different types of South African wine were analysed for overall chemical and nutrient composition. Rats were fed purified diets supplemented with wine and food consumption and mass gain was measured. At the end of the experimental period, serum samples were analysed to determine the nutritional and metabolic influence of the different types of wines.

THIS INVESTIGATION into the nutritional and metabolic influence of different types of wines was carried out on four wines from grapes grown in the Cape Province, and made by the Stellenbosch Farmers' Winery – dry white, semi-sweet white, dry red and low alcohol dry white.

Original wines and lyophilized wine samples were analysed by conventional methods for reducing sugars, phenols, free amino nitrogen, aldehydes, esters and minerals.

Alcohol and caloric content were determined only in original wine samples.

The pH of lyophilized and original wines was maintained within the same range. Min- content was determined by atomic absorption spectroscopy and the caloric content of the wine was determined by bomb calorimetry. Amino acids in duplicate hydrolysate of each lyophilized wine sample were determined quantitatively with a Beckman Model 119 automatic amino acid analyser following hydrolysis of the samples for 24 hours at 110 °C with 6 M HCl in evacuated tubes. Serum analysis was performed using conventional clinical procedures.

Male Wistar rats of 120 g mass were housed individually in stainless-steel metabolism cages and fed a diet of 70,5 % starch, 18,0 % ovalbumin, 5,0 % salt-mix, 5,0 % sunflower oil, 1,0 % cod liver oil, 0,3 % choline chloride and 0,25 % vitamins. The diet, including salt and vitamin mix, was composed according to Mutch & Hurley, 1974, and the animals were provided with water.

The animal room was kept at a constant temperature of 28 °C with 12 hours of daylight out of every 24, and alcohol was given to the rats only once daily. The control animals were subjected to the stomach tube-feeding procedure of a wine-free diet made once and stored in a cold room. Food was

withheld for 18 hours prior to the various serum analyses.

The experimental animals were fed the same diet as the control animals along with lyophilized wine at a concentration equal to 2 ml original wine per day, per rat.

Both the control and experimental animals received the alcohol equivalent of this wine intake at a rate of 1 ml of 24 % ethanol/day by stomach intubation.

After four weeks on these diets the animals were slaughtered and blood samples were withdrawn from their hearts. The serum was analysed for total protein, globulin, urea, alkaline phosphatase and amylase by the Department of Chemical Pathology, University of Natal, Durban. The serum mineral concentrations were determined by atomic absorption spectroscopy. Normal rat serum was taken from the serum bank as a standard for comparison of results received during the experiments.

Total cholesterol – high density lipoproteins (HDL) and low density lipoproteins (LDL) – was measured by the methods of Epstein, 1971, Ononogbu and Lewis, 1976, and Trinder, 1969.

Polyacrylamide gel electrophoresis (PAGE) was performed in 4,5 % (poly) acrylamide gel (P) AAG, as described for serum proteins. Molecular weight (apparent) MW, distribution of rat serum proteins was estimated by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS – PAGE) in 5,0; 7,7; and 10,0 % (P) AAG, containing 0,1 % SDS. Serum proteins were previously reduced by boiling for five minutes in 0,01 M-sodium phosphate buffer pH 7 containing 1 % SDS and 1 % mercaptoethan-2-ol (ME). Coomassie Brilliant Blue (CBB) R250 was used as protein stain.

Photographs of electrophoregram patterns after SDS-PAGE were taken against a dark

background with indirect lighting, using a Polaroid Land MP3 camera. Quantitation of bands resolved by SDS-PAGE was determined by scanning the (P) AAG cylinder.

Polyacrylamide isoelectric focusing (PAGIF) from serum of rats fed on the four different types of wine was performed in a gradient of ampholine carrier ampholytes pH 5,5 – 8,5, in a thin-layer (P) AAG at 4 °C using an LKB Multiphor 2117 apparatus.

## RESULTS AND DISCUSSION

Serum protein and mineral concentrations were similar in all groups. Serum urea, on the other hand, was significantly lower in animals fed the dry white wine, indicating a beneficial effect of this wine diet on protein catabolism. Serum alkaline phosphatase activity was significantly lower in all groups fed wine-supplemented diets. These results point to a beneficial effect of wine on bone metabolism and may be due to stimulated excretion.

Serum amylase activity was also significantly lower in animals on wine-supplemented diets when compared with controls but the significance of this finding is unclear. Considerably elevated serum amylase is used as an indicator of pancreatic related disorders. As a result, while the wine diets result in depressed 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.

Feeding of the wine diets had an effect on the plasma lipid levels, while in only some cases it was shown to be significant. The concentration of HDL was increased by feeding the rats dry white wine and low alcohol wine but dry red wine and semi-sweet white wine decreased the concentration. The concentration of LDL was increased with semi-sweet white wine and significantly increased with a low alcohol wine ( $P < 0,05$ ), while dry white wine and dry red wine had no effect. The total cholesterol concentration was significantly increased by low alcohol wine ( $P < 0,05$ ). It was also increased by dry white wine and semi-sweet white wine but decreased with dry red wine. The total triglyceride concentration was increased by dry white wine but decreased by the other wine diets.

These data indicate that wine supplemented diets may significantly affect the concentration of serum cholesterol in different blood lipoprotein fractions. This result is in agreement with other similar studies on the effect of alcohol on lipoprotein cholesterol concentrations.

It has previously been shown that a number of other dietary factors, such as hypertension and genetic disorders, can affect the levels of HDL and LDL cholesterol. This may be of considerable significance since it has been suggested that LDL has a detrimental effect on heart disease by promoting atherosclerosis while HDL possibly has a beneficial effect by helping to prevent atherosclerosis.

PAGE was used to detect the differences in globulin and albumin patterns of serum from all rats in the same groups of the experiment. No differences were observed in the serum samples of the six rats in each group.

Serum globulin and albumin fractions from the rats fed the different wine diets have similar specific electrophoretic patterns with some slight differences. SKS-PAGE in 5,0, 7,5 and 10,0 % (P) AAG mostly detected six main protein fractions with an MW of 153,0, 135,0, 119,0, 56,0 and 27,0 kilo-Dalton, unit  $\times 10^3$  of apparent MW (kD).

The band of MW 27,0 kD is the strongest in normal serum and slightly stronger in red wine than the other wine samples. Only the serum of rats fed red wine had strong subunit in 14,0 kD while less material was presented in all the bands obtained with serum from rats fed low alcohol dry white wine. Therefore SDS-PAGE and quantitative scanning of separate fractions revealed only slight differences in serum protein composition. Major heterogeneous banding patterns obtained in the region with IP of pH 7,5 - 8,5 were the strongest in the serum of rats fed dry red wine. Minor bands were obtained with isoelectric point (IP) at more acidic pH values (6,5 - 7,5).

#### CONCLUSIONS

The caloric content of wine is of interest to the wine industry as it is one of the factors which can be altered by choice of cultivar and fermentation process. However, although the caloric content of the different wines studied varied significantly, this factor had no apparent effect on the overall metabolism of the animals as determined by the various physiological parameters measured in this study. Likewise, the mineral content of beverages such as wine is influenced by the soil in the area of cultivation, by the climatic conditions and by the actual fermentation process.

However, as can be seen from the results of this study, consumption of wine resulted in little effect on the mineral balance in the experimental animals.

The different wines varied slightly with respect to nutrient and chemical composition. This variability is reflected in their nutritional values when fed to rats. Electrophoretic patterns of serum proteins differ to a small degree with the type of wine fed, but the nutritional and physiological significance of these differences is not clear. On the other hand, consumption of certain types of wine, such as dry white wine, may result in few differences in reduced protein catabolism as indicated by lower serum urea levels.

This is of interest to the wine producers as it may be possible to alter the composition of other wines to give the same benefit on protein metabolism without changing their taste and character to any great extent. It would also appear that the wine-containing diets resulted in an improved bone status in

test animals which is advantageous from a nutritional point of view since vitamin D has a regulating influence on bone metabolism and structure.

Finally, it can be concluded from this study, the first such investigation of the nutritional value of South African wines, that the consumption of wine is, if anything, nutritionally beneficial.

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#### REFERENCES, TABLES AND FIGURES

References, tables and figures pertaining to the above study are obtainable from the editorial office of FOOD REVIEW. □

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