

## INVESTIGATIONS ON THE CONSUMPTION OF SUGAR BY SOUTH AFRICAN POPULATIONS\*

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### SUMMARY

By means of questionnaires, appropriate for both individuals and households, surveys of sugar intake have been carried out in the Transvaal on groups of South African Whites, Indians, Malays, Coloureds, and Bantu. Inquiries concerned groups in urban and rural areas, and in different socio-economic circumstances.

In Whites the consumptions per capita resemble data published in the United Kingdom. Mean intakes, in round figures, range from 80 to 100 g per day for those in the higher socio-economic groups, to 120-140 g for those in lower-income groups.

For Indians the mean consumptions, 70-90 g, are less than the intakes of Whites, and slightly less than the limited data on Coloureds and Malays.

The Coloureds and Malays were not extensively investigated; the mean intakes of about 90 g are lower than those of Whites in similar economic circumstances.

Among the rural groups of Bantu studied, mean intakes range from 65 to 75 g per day, while in urban areas ranges are greater, 55-85 g per day.

Miscellaneous findings were that males consume more sugar than females; intake rises with age, but falls off in late middle-age; intake falls with increase in family size; and among Whites, intake tends to decrease with rise in privilege (this change is not yet apparent in non-White groups). In the future, sugar intake will certainly increase in the non-White populations, particularly the Bantu.

To secure information on sugar consumption per capita three methods can be followed: (i) by determining in a country the total amount available both for consumption and industrial use, and dividing the figure by the total population; (ii) by determining the consumption in households, using a questionnaire, and then dividing the amount by the number of members, in terms of man-units; and (iii) by determining the consumption of individuals, using one questionnaire for each member.

Results may be given as g or ounces per diem, or as kg or pounds per annum (100 g sugar per diem equals 3.5 oz per diem, or 36.5 kg, or 80.3 lb per annum).

The three approaches will now be enlarged on in some detail.

*The nation-wide approach.* The results obtained, understandably, give higher figures than those found for the constituent households or individuals, since they include sugar used for industrial and other purposes. However, as will be indicated later, the discrepancy is far greater than would be expected; the explanation is not clear. Data per capita are available for most countries in Food and Agriculture Organization publications, in particular, *The State of Food and Agriculture*,<sup>1</sup> and *Review of Food Consumption Surveys*.<sup>2</sup> A summary of information, mainly for 1962-1966,<sup>1</sup> is given in Appendix I.

*Studies on households.* Investigations of consumptions of

foodstuffs by households, with subsequent calculations for intakes of single nutrients, have been pursued for many years in several countries, especially in the United Kingdom,<sup>3,4</sup> USA<sup>5,6</sup> and the Netherlands.<sup>7</sup> The questionnaires used, generally covering a period of a week, or occasionally a month, differ somewhat from country to country. The form we employed to determine sugar consumption in households is given in Appendix II.

The total intake of sugar is made up of (i) the amount purchased (often referred to as household sugar), and (ii) the amount contained in preserves, fruit, condensed milk, confectionery, honey, sweets, soft drinks, etc. These latter amounts are calculated from information given in Appendix IV, also from food composition tables. From the combined information, the total sugar intake is divided by the number of persons in the household, reckoned as man-units (Appendix V). This figure is then divided by the period of days covered (28 or 30 days) to yield the consumption per man-unit per diem. The procedure described has been used not only for countries, but also for regions, and for particular classes of population (e.g. farmers, industrial workers, etc.).

*Studies on individuals.* The best questionnaire is considered to be that of Yudkin and co-workers.<sup>8</sup> We used their form, as given in Appendix III, although slight modifications were made for the non-White populations. Consumptions are calculated in a manner similar to that for households. The questionnaire may be employed to elucidate the sugar consumption of male and female, old and young, and of course numerous other categories of persons.

It must be appreciated that in all endeavours to learn of food consumption in a person's past, there are a number of uncertainties. Some of these were recently discussed by Booyens *et al.*<sup>9</sup>

### SUBJECTS AND METHODS

#### White Groups

These were studied as follows:

*Johannesburg.* The higher socio-economic areas were Saxonwold, Cyrildene, Emmerentia, Northcliff and Linden. The lower socio-economic areas were Malvern and Judith Paarl. Parkhurst may be regarded as intermediate. The South African Railway groups were graded socio-economically from A (best group R3 750 or more per annum), to B (R2 700-R3 750 per annum), to C (R1 020-R2 700 per annum). The Witwatersrand University Medical School Staff group was wholly professional; the student group was composed of subjects having different socio-economic backgrounds.

*Eastern Transvaal.* At Komatipoort the sugar intake of almost every White household was investigated. Workers were mainly Railway employees. The Komatipoort farmers group resided within 25 miles of the town. At Sabie, attempts were made to obtain information from a selection of households classified as upper, middle and lower, according to socio-economic state.

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*Cape Town.* Studies in this city were undertaken by the same worker who carried out most of the investigations in Johannesburg. Rugby may be regarded as a somewhat poor area, and Camps Bay, mainly middle class. The inquiries at Knysna included individual consumption studies on a representative group of the population; on the other hand, the information on households concerned mainly the poorer segment of the population.

#### Indians

The group at Lenasia, Johannesburg, was composed of families in the middle-income bracket. Approximately equal numbers of Hindu and Moslems were questioned. The groups at Rustenburg and Loui's Trichardt were representative of urban Indian traders, most of whom were in comfortable circumstances; e.g. all had cars, and Bantu servants. In the three regions mentioned, the groups were predominantly Moslem.

#### Malay

The group studied at Bosmont, Johannesburg was composed of persons in full employment, and in comfortable circumstances. Almost all had cars, and Bantu servants.

#### Coloured

The group studied at Bosmont, Johannesburg, was composed of persons in full employment, and in comfortable circumstances. Almost all had cars, and Bantu servants.

#### Bantu

In Soweto, Johannesburg, those questioned at Dube were in the highest income bracket. The Senoane group may be regarded as relatively less privileged, as were also the groups at Zola North and Zola North-West. The two Zola groups primarily concerned old people (i.e. over 60 years of age) and their families. Regarding the Bantu groups in the country districts of the Transvaal, at Tleseng (15 miles west of Rustenburg) the workers were mainly farm labourers. This was also the case at Insikazi Reserve (20 miles east of White River). Both these country groups, in Bantu Reserve areas, were poor. At Graskop, the persons questioned were farm labourers, also workers at the local sawmills; employment was probably more regular than at Tleseng or Insikazi.

All places in the country are those where other research projects have been undertaken or are in progress.

### PROCEDURE

#### Whites

Most of the groups studied were questioned by one of us (C.M.H.). The others were investigated by local helpers such as teachers, social workers, or senior university students.

#### Non-Whites

Investigations were undertaken mainly by local non-White teachers or senior students. These people, after preliminary inquiries, were able to appropriately modify the question form used for Whites.

In the case of the Whites, a strong endeavour was made at the commencement to obtain data on representative population groups in a truly random manner. But soon it transpired that this exacting procedure was not practicable. Some individuals in the chosen defined areas were seldom

at home, or too busy, or did not take the inquiry seriously. A few others were forgetful or gave obviously incorrect information; moreover, most of such people resented attempts at checking. Ultimately, it was left to the judgement of the workers to compile as representative a number of satisfactorily filled-in replies as possible.

In the non-White groups, the above problems were less conspicuous and we believe that the results obtained are reasonably representative. Dwellings were visited in an approximately random manner near to the questioner's own residence. In the cases of the Whites, Indians, Malays and Coloureds, forms were left and collected later, when any items puzzling or uncertain to consumers were explained. With regard to the Bantu consumers, the interviewer usually helped to correlate the information.

#### Calculations

The amount of sugar in particular measures, and in quantities of foods and beverages, are given in Appendix IV. The food tables of Fox<sup>10</sup> were mainly used; for certain items those of McCance and Widdowson<sup>11</sup> were employed.

### RESULTS

Tables I and II summarize data on the sugar consumptions of individuals and of households in the White groups; Tables III and IV give the corresponding data on the non-White groups.

For comparison, good data for groups mainly of White adult males have recently been published, and are given in Table V. The figures were secured principally in investigations linked with seeking to determine the role of sugar in the development of ischaemic heart disease.<sup>10-20</sup> For further comparison data have been assembled on populations in countries in different parts of the world; these are given in Tables VI and VII. To make fair comparisons the original papers should be consulted.

### COMMENTS ON RESULTS

#### Preliminary Comments

Before making comparisons, a number of points require discussion.

*Were the questionnaires satisfactory?* The individual form, as developed by Yudkin and co-workers,<sup>8</sup> is very satisfactory for the purpose. The household form, which we prepared, and which differed slightly for the different races, is probably less satisfactory, although few housewives could think of items (other than minor) that were not taken into reckoning. It is probable that the errors implicit in the calculations (Appendices IV and V) render the household data less accurate than such derived from the forms for individuals.

*Were the data valid?* Incorrect figures may be given as a result of casualness, forgetfulness, in an effort to please the questioner, and for other reasons. In a study in London<sup>21</sup> on elderly people, it was found that the amount of sugar purchased was double that elicited from inquiry into actual consumptions. Further, many people are aware that excessive consumption of sugar is deleterious; hence, intelligent housewives may tend, consciously or unconsciously, to underestimate their actual intakes. Notwithstanding, it is considered that the data secured are reasonably valid. It will be understood that the greater the ratio of household sugar intake to sugar in foods (jam, etc.), the more reliable

TABLE I. INDIVIDUAL SUGAR CONSUMPTION BY WHITES

Population	Males		Females	
	No. of subjects	Means and ranges (g/day)	No. of subjects	Means and ranges (g/day)
Johannesburg				
Cyrildene	20	79 5 - 198 (17 - 187)	53	51 4 - 150 (11 - 136)
Saxonwold			32	66 7 - 242 (12 - 205)
Linden	27	99 7 - 347 (21 - 163)	57	71 8 - 228 (14 - 168)
Medical school staff	25	73 22 - 170 (23 - 162)	13	71 5 - 188 (10 - 153)
Medical school students (anatomy)	108	104 10 - 327 (33 - 199)	34	54 5 - 126 (10 - 109)
Malvern			27	147 10 - 375 (25 - 349)
Judith Paarl			48	121 16 - 280 (26 - 230)
S.A. Railways A (upper)	50	79 6 - 192 (10 - 154)		
S.A. Railways B (middle)	50	109 24 - 350 (33 - 235)		
S.A. Railways C (lower)	50	122 9 - 251 (27 - 240)		
Elsewhere				
Cape Town: Rugby			35	125 10 - 340 (14 - 278)
Cape Town: Camps Bay	26	114 16 - 320 (18 - 288)	40	77 8 - 204 (11 - 157)
Knysna	24	113 6 - 339 (7 - 265)	31	70 11 - 213 (13 - 181)

Ranges in parentheses relate to the 90% range.

are consumption data likely to be.

*Were data representative?* Should another worker study groups closely similar to those described, would results of the same order be obtained? Furthermore, should a particular group be questioned again soon afterwards, would the same results be yielded? From our preliminary pilot studies, we believe that provided questionnaires are filled in carefully, results are both fairly representative of particular groups, and are repeatable. Nevertheless, it must be realized that in a given community, *all* groups cannot be answered for, e.g. male, female, young, old, rich, poor, active, sedentary, etc. Our results must therefore be regarded primarily as reflections or profiles of sugar intake situations, rather than as precise pictures of communities in which all constituent populations are proportionally represented.

*Miscellaneous influencing factors.* It is important to record the season of the year in which inquiries are made. For example, both the fruit season (with the associated home-bottling of fruit), and summer temperatures (affecting frequency of consumption of soft drinks), increase sugar consumption data. The extent to which mothers pre-

pare their own food (home-bottling, cake-making, etc.) obviously influences the amount of household sugar bought, and its ratio to sugar in purchased foods. Broadly, however, we believe that our results provide a fair indication of the sugar intake in the populations studied.

#### General Comments on Results

*Household versus individual intakes.* There is no doubt that the sugar intake data derived from the two approaches are complementary. Inquiries from individuals, however, as previously indicated, are likely to yield more reliable results.

It is important to recognize that there is a large discrepancy between daily sugar consumption *per capita* as assessed by the nation-wide method of estimation (see above, also Appendix I), and consumption data as estimated from the approaches employing either household or individual questionnaires. For example, in the United Kingdom, the former method has given a mean daily figure of 136 g,<sup>1,2</sup> yet extensive household studies have yielded a mean figure of 82 g, made up of 70 g sugar (purchased as sugar), and 12 g from preserves.<sup>3</sup> The differ-

TABLE II. SUGAR CONSUMPTION PER MAN-UNIT BY WHITE HOUSEHOLDS (MEANS AND RANGES)

Population	No. of homes	Household sugar (g/day)	Sugar in food (g/day)	Total sugar (g/day)
Johannesburg		51	28	79
Cyrildene	48	10-208 (12-100)	2-87 (6-50)	20-247 (28-161)
Saxonwold	31	60 14-121 (18-94)	27 3-84 (8-46)	87 24-148 (37-121)
Linden	48	68 15-155 (19-153)	30 4-144 (5-56)	98 20-218 (30-178)
Northcliff	27	56 10-151 (19-90)	33 6-133 (7-59)	89 18-218 (22-140)
Emmerentia	30	70 26-145 (37-120)	34 9-92 (10-61)	104 35-237 (47-181)
Parkhurst	24	69 18-135 (22-108)	39 4-104 (12-87)	108 31-199 (38-187)
Malvern	27	83 19-211 (37-187)	60 11-129 (20-121)	143 47-308 (67-218)
Judith Paarl	44	84 26-253 (45-142)	52 12-176 (15-101)	136 59-351 (79-248)
Elsewhere				
Sabie: upper-income group	16	69 30-120 (38-112)	27 2-80 (11-53)	96 40-166 (60-155)
Sabie: middle-income group	21	72 37-150 (45-123)	24 9-41 (12-39)	96 46-191 (53-153)
Sabie: lower-income group	18	81 37-156 (60-129)	28 6-100 (9-46)	109 56-230 (73-156)
Komatipoort	140	108 19-253 (55-185)	25 3-177 (5-60)	133 30-368 (62-229)
Komatipoort farmers	39	95 34-233 (49-193)	17 6-41 (8-35)	112 47-259 (59-210)
Cape Town: Rugby	35	75 15-151 (22-112)	54 9-136 (16-111)	129 24-207 (48-186)
Cape Town: Camps Bay	45	60 7-151 (15-93)	39 4-144 (5-81)	99 19-199 (28-161)
Knysna	64	149 56-351 (67-265)	23 3-65 (8-53)	172 64-382 (78-292)

Ranges in parentheses relate to the 90% range.

ence, 54 g, is far larger than can be due to items not normally included in household surveys, by meals eaten away from home, etc. Furthermore, it will be noted from Table V that most of the questionnaire studies on sugar consumption carried out in the UK have yielded figures less than 100 g *per diem*. Clearly, data on *national* sugar consumption cannot be used for epidemiological investigations.

*Ranges of sugar intake.* A conspicuous feature is the wide range of intakes seen in all the racial groups studied. Daily consumption may be as low as 4 g, as among certain Bantu, or at the extreme, as high as 351 g, as occurred in households at Judith Paarl, Johannesburg, and 382 g at Knysna. In the particular households at Judith Paarl, the high consumption is partially explicable since it occurred

in a month when fruit was being bottled. In the groups the ranges of the intakes which encompass 90% of consumers are believed to be more realistic than the ranges that include all consumers. Our data indicate, however, that excessively high consumptions in households and by individuals are far from rare. Yudkin<sup>44</sup> noted that in the UK 'many persons consume less than 45 g and very many consume more than 150 g'.

*Intakes of household sugar versus sugar in foods.* It will be apparent from our results that in respect of the amounts of sugar ingested or *added* to beverages or foods, mean intakes from these sources do not differ very markedly in the different races studied. On the other hand, there are enormous differences between the amounts of sugar ingested from drinks and foods *containing* sugar. In the case

TABLE III. INDIVIDUAL SUGAR CONSUMPTIONS BY NON-WHITES

Population	Male		Female	
	No. of persons	Means and ranges (g/day)	No. of persons	Means and ranges (g/day)
<b>Bantu</b>				
Dube, Johannesburg			62	76 5 - 286 (11 - 168)
Senoane, Johannesburg			18	59 4 - 147 (6 - 139)
Zola North, Johannesburg			29	55 8 - 269 (10 - 120)
<b>Indians</b>				
Louis Trichardt	14	104 32 - 239 (33 - 200)	12	77 32 - 160 (41 - 135)
Lenasia, Johannesburg	20	80 8 - 265 (16 - 148)	22	72 15 - 210 (18 - 134)
<b>Malays</b>				
Bosmont, Johannesburg	20	106 44 - 266 (48 - 182)	19	94 43 - 181 (46 - 131)
<b>Coloureds</b>				
Bosmont, Johannesburg	19	98 28 - 157 (34 - 151)	21	72 8 - 158 (36 - 128)

Ranges in parentheses relate to the 90% range.

TABLE IV. SUGAR CONSUMPTION PER MAN-UNIT BY NON-WHITE HOUSEHOLDS (MEANS AND RANGES)

Population	No. of households	Household sugar (g/day)	Sugar in food (g/day)	Total sugar (g/day)
<b>Bantu</b>				
Insikazi, E. Transvaal	34	65 15 - 169 (30 - 109)	3 0 - 16 (2 - 9)	68 16 - 175 (30 - 114)
Graskop, E. Transvaal	56	71 14 - 187 (20 - 128)	5 0 - 28 (1 - 16)	76 15 - 199 (23 - 136)
Tlesing, W. Transvaal	27	56 9 - 189 (12 - 150)	9 0 - 45 (1 - 29)	65 9 - 234 (13 - 179)
Dube, Johannesburg	41	64 14 - 212 (16 - 150)	22 0 - 88 (2 - 54)	86 18 - 282 (23 - 179)
Senoane, Johannesburg	42	42 11 - 226 (15 - 90)	14 0 - 47 (3 - 43)	56 11 - 273 (18 - 133)
Zola North, Johannesburg	41	49 11 - 106 (22 - 79)	12 0 - 64 (2 - 33)	61 13 - 115 (26 - 93)
Zola North-West, Johannesburg	72	50 5 - 181 (19 - 99)	13 0 - 40 (2 - 30)	63 7 - 205 (27 - 129)
<b>Indians</b>				
Rustenburg	69	65 24 - 151 (31 - 101)	20 4 - 94 (6 - 36)	85 30 - 230 (37 - 130)
Louis Trichardt	21	54 13 - 105 (23 - 95)	28 4 - 94 (7 - 57)	82 20 - 187 (35 - 159)
Lenasia, Johannesburg	21	46 20 - 105 (25 - 82)	22 3 - 62 (6 - 55)	68 25 - 160 (33 - 123)
<b>Malays</b>				
Bosmont, Johannesburg	23	56 16 - 101 (26 - 99)	35 11 - 152 (15 - 61)	91 27 - 253 (41 - 160)
<b>Coloureds</b>				
Bosmont, Johannesburg	18	63 28 - 145 (38 - 110)	28 10 - 70 (14 - 43)	91 38 - 215 (52 - 153)

Ranges in parentheses relate to the 90% range.

of Bantu in the country, the intake from these sources is negligible. However, as westernization proceeds, this sugar intake will undoubtedly increase.

*Interracial overlap of data.* In each race there were moieties which have approximately the same sugar intake. In this respect, it would be of great interest, in the four races studied, to locate sufficiently large numbers of adults in a particular age-group who have much the same sugar consumption; this should permit the making of comparisons of the prevalences of obesity, diabetes, coronary heart disease, and of blood lipid concentrations, response to the glucose-tolerance test, etc.

*Racial comparisons.* In urban areas, broadly speaking, our results indicate that South African White populations have higher intakes of sugar than the Coloured, Indian, Malay, and Bantu populations studied. But only among rural Bantu are intakes considerably lower than those of Whites.

(i) South African Whites: for the different groups studied, results are similar to those published for populations in the UK. For example, in a socio-economically poor moiety, e.g. railway group C, the intake of 122 g of

TABLE V. SUGAR CONSUMPTION BY WHITE POPULATION GROUPS

Population groups, mainly in UK		No. of persons	Age (years)	Sugar intake (g/day)
Marr & Heady <sup>12</sup>	Bankworkers, healthy males	99	40-55	109
	Bus drivers, healthy males	60	45-65	118
	Bus conductors, healthy males	48	45-65	128
Yudkin & Roddy <sup>12</sup>	Healthy males	25	56	77
Yudkin & Morland <sup>13</sup>	Healthy males	20	55-4	78
Bett <i>et al.</i> <sup>5</sup>	Healthy factory and office workers; males and females	16	19-7	120
Papp <i>et al.</i> <sup>15</sup>	Healthy factory and office workers: males and females	16	38-1	110
	Controls, males	20	43-65	117
Paul <i>et al.</i> <sup>16</sup>	Controls, males	85	40-55	96-0
Finegan <i>et al.</i> <sup>17</sup>	Controls, males	50	30-59	69
Finegan <i>et al.</i> <sup>18</sup>	Controls, females	50	30-59	65-2
Howell & Wilson <sup>19</sup>	Controls, males	1 158	44-58	77-6
Burns-Cox <i>et al.</i> <sup>20</sup>	Controls, males	160	under 60	96-9
Bennett <i>et al.</i> <sup>21</sup>	Non-smokers, healthy males	65	44-58	77
	Ex-smokers, healthy males	541	44-58	70
	Current smokers, healthy males	424	44-58	89
Elwood <i>et al.</i> <sup>22</sup>	Healthy males	261	20-64	92
	Healthy males	62	20-64	88

TABLE VI. POPULATION GROUPS WITH LOW SUGAR INTAKE

Population group	Sugar (g/day)	Population group	Sugar (g/day)
UK: vegetarians <sup>23</sup>	31	South American Indians <sup>21</sup>	32
France: peasants <sup>24</sup>	35	Near East <sup>22</sup>	15
Italy: rural <sup>25</sup>	30	Gaza strip <sup>23</sup>	20
Italy: very poor <sup>26</sup>	0	Israel: pregnant women <sup>24</sup>	36
Italy: metal workers <sup>27</sup>	16	Jordan <sup>25</sup>	56
Sicily: rural <sup>28</sup>	10	China: naval station <sup>26</sup>	16-5
Sardinia: rural <sup>29</sup>	10	India: rural workers <sup>27</sup>	'negligible'
Serbia: rural <sup>30</sup>	7	India: peasants <sup>28</sup>	7

TABLE VII. SUNDRY POPULATION GROUPS WITH MODERATE OR HIGH SUGAR INTAKE

Population group	(g/day)	Population group	Sugar (g/day)
UK: Midlands <sup>31</sup>	98	Chile: urban middle-class <sup>40</sup>	68
London <sup>29</sup>	80	Venezuela <sup>41</sup>	71
USA: North-East <sup>42</sup>	72	Sahara: soldiers <sup>42</sup>	158
South <sup>43</sup>	100		

sugar corresponds with that of London bus drivers, 118 g, and conductors, 128 g<sup>12</sup> (Table V). Furthermore, in Johannesburg, in our groups in comfortable circumstances, mean intakes, 79 - 104 g *per diem* are of the same order as that found in a similarly placed adult male group in Cape Town, 88 g.<sup>45</sup>

(ii) South African Indians: our intakes for households, 68 - 85 g *per diem*, may be regarded as representative of the sugar consumption of middle-class Transvaal Indians. Their general economic situation is higher than in Durban, where probably 60% or more 'live under conditions of poverty'.<sup>46</sup> In 1964, in that city, painstaking studies on the income and expenditure of urban Indians were carried out by the Bureau of Market Research, University of South Africa.<sup>47</sup> It was found that the average figure *per capita* spent on sugar and allied products was 25 cent per month, which at that time, in purchasing capacity, would be equivalent to about 45 - 50 g sugar *per diem*. In a recent study in Durban, Booyens and De Waal<sup>48</sup> found mean intakes of household sugar in diabetic adult males and females, and in non-diabetic adult male and females, to be 19.9, 14.0, 20.7 and 31.5 g *per diem*, respectively. For total sugar intake (including sugar in foods such as condensed milk, etc.) these amounts require to be increased by 20 - 25%, and become, approximately, 25, 17.5, 26 and 40 g *per diem*, respectively. In strong contrast, however, Cleave *et al.*<sup>48</sup> have given a *per annum* figure of '110 lb for

the Indians of Natal' (method of estimation not stated). This is equivalent to 137 g *per diem*, a figure tremendously higher than the other consumption data given and which, without adequate validation, cannot be used for epidemiological purposes.

(iii) Coloureds: our investigations on the group in Johannesburg indicate a mean intake of about 85 - 90 g *per diem*. The expenditures *per capita* disclosed by the Bureau of Market Research in 1964 were 52 and 46 cent for the groups of Coloureds studied in Durban<sup>47</sup> and in the Cape Peninsula.<sup>49</sup> These sums correspond with sugar intakes of 90 - 100 g *per diem*, values in line with our data.

(iv) Bantu: although limited data are available on sugar intake many years ago,<sup>50</sup> the more recent studies by the Bureau of Market Research on urban Bantu afford much more satisfactory comparisons. Investigations were undertaken during 1960 - 1965 in Benoni,<sup>51</sup> Pretoria<sup>52</sup> and Cape Town.<sup>53</sup> Mean monthly expenditure per household, was R1.50 at Pretoria and R1.70 at Benoni; allowing for the average size of families studied, these sums indicate mean intakes *per capita* of about 75 g and 85 g *per diem* respectively. For urban Venda adult males in Johannesburg in 1969, Lubbe<sup>54</sup> found sugar consumption to average 68 g daily. These figures lie within the ranges of the means which we found, namely, 56 - 86 g *per diem*. Although, in 1958 - 1961, Abramson *et al.*<sup>55,56</sup> carried out careful nutritional and other health studies on groups of Bantu and Indians in Durban, mean data on sugar intakes were not given.

*Males versus females.* In all studies, intakes of males are greater than those of females; this is especially marked in the student groups. Our results, in respect of the sex difference, are in agreement with those reported from other countries. For example, in a study of the dietary habits of students at Leyden University in the Netherlands, it was reported that 'less than 30 g sugar daily was used by 75%; men ate twice as much as women'.<sup>57</sup>

*Effects of age.* Our results in the four racial groups (not given in the tables) indicate a rise in intake up to 30 years or so, followed by a decrease which becomes very marked in late middle age. Little *et al.*<sup>58</sup> noted a similar pattern of change in the groups of Canadians studied.

*Family size.* In all racial groups, although less conspicuously in Whites, a fall in sugar consumption was noted with the increase in the size of the household. A similar fall was also apparent in the non-White groups studied by the Bureau of Market Control.<sup>47,49,51-53</sup>

*Socio-economic effects.* In general, beginning at the poverty datum line, sugar intake rises with income. This occurred with the four races. A stage is reached, however, beyond which consumption falls. In Whites, this trend is apparent from our data (e.g. on railway workers in Johannesburg, and on the groups at Sabie) and also from the figures given for different groups in the UK (Table V). This fall is not yet apparent in the non-White groups.<sup>47,49,51-53</sup>

*Effect of cultural differences.* In respect of nations, there may be considerable differences in sugar intake between those that have the same levels of socio-economic state and of culture. For example, sugar consumptions in France and Belgium are much lower than those of the USA or the UK<sup>1</sup> (Appendix I). Furthermore, although Japan now enjoys a high level of prosperity, sugar intake remains low;<sup>1</sup> the principal reason probably is that sugar is not added to

green tea, which is their national drink.<sup>50</sup> In particular groups in western countries, sugar intake may be low, as among vegetarians in the UK,<sup>23</sup> and in rural groups in France<sup>24</sup> and Italy.<sup>25-28</sup>

**Urban-rural differences.** Sugar consumption may differ from region to region. In the West, this is apparent in data from the USA and the UK (Tables VI and VII). Furthermore, as already mentioned, consumption among the poor in rural areas, even in western countries remains low (Table VI). In the East, in urban and rural India in 1960-1961, monthly household food expenditure *per capita* averaged 0.91 and 0.61 rupees.<sup>2</sup>

#### DISCUSSION

##### Were Results as Expected?

**Whites.** Consumptions of sugar, as surmised, were found to be of the same order as those reported from the UK.<sup>12-22</sup>

**Indians.** Consumption was less than anticipated, judging from general information given by Cleave *et al.*<sup>45</sup> yet were consistent with data from other sources.<sup>46,47</sup>

**Coloureds and Malays.** Data on Coloureds were in agreement with data obtained by the Market Research Bureau.<sup>48,49</sup>

**Bantu.** The current rural and urban Bantu groups studied consumed sugar more or less as expected. Their high consumptions in tea and soft-drinks are somewhat offset by the relatively low consumptions derived from confectionary, etc.

##### The Outlook for the Future

**Whites.** In some western countries (Poland,<sup>60</sup> Czechoslovakia,<sup>61</sup> Russia<sup>62</sup>), very marked increases in sugar consumption have occurred in the past 10-20 years. On the other hand, in countries where consumptions are already high, e.g. UK<sup>3,4</sup> and Holland,<sup>7</sup> it would seem that a steady rate of consumption has been reached. It is questionable whether intakes in such countries will increase further.

**Developing populations.** In such populations intakes have greatly increased, and may be expected ultimately to reach levels found in the economically poorer moieties of White populations, i.e. 120-140 g *per diem*. This will be the trend of change in the future even in countries that are poor and have to import sugar (e.g. India,<sup>63</sup> Pakistan,<sup>64</sup> Malaya<sup>65</sup>).

##### Harmfulness of Excessive Intake of Sugar

This issue has been mentioned previously,<sup>66</sup> and reviewed elsewhere,<sup>67</sup> yet the subject merits much more detailed study than can be given in this contribution, which is primarily concerned with sugar intake in South African racial groups. But briefly, the issue is not so much: is a high consumption of sugar harmful?—but rather: is a high consumption of sugar deleterious in comparison with an equal amount, calorically, of other foodstuffs? Or, more succinctly, is a high consumption of sugar *per se* conducive to obesity, diabetes, or coronary heart disease? Efforts to throw light on the issue have been the object and burden of numerous investigations, critical reviews, etc. The complexity of human contexts, and involvement of genetic and environmental factors (dietary and non-dietary), render it difficult to define the extent of the role of sugar in the development of the diseases mentioned. With regard to coronary heart disease, however, upon which much appro-

priate inquiry has been concentrated, all investigations,<sup>15-22</sup> save those of Yudkin and co-workers,<sup>13,14</sup> have yielded negative results.

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No. of persons in household:  
 Adults over 21 years ..... Children of 12 years and under .....  
 Children 13 - 20 years .....  
 Servants: Full-time .....  
 Part-time ..... Number of meals .....  
 What quantities of the following foodstuffs are bought and consumed by your household each month?  
 Sugar ..... 'Soft' drinks: King size .....  
 Jam, marmalade ..... Family size .....  
 Canned fruit ..... Condensed milk .....  
 Honey ..... Syrup .....  
 Fruit juice as bought ..... Fruit concentrate .....  
 Sweets ..... Chocolate .....  
 Cakes & pastries bought ..... Biscuits bought .....  
 Ice cream ..... Jellies & puddings bought .....  
 Meals eaten out per month .....  
 How many visitors do you have and how often do they come?  
 I have an average of ..... guests eating ..... meals a month.  
 Do you consider any member of your family to be overweight?  
 Adult ..... Child .....

Date: ..... Signed: .....

APPENDIX I. SUGARS AND SWEETS AVAILABLE FOR HUMAN CONSUMPTION (FAO, 1968) (per capita per diem)

Europe	South America		
Denmark	139	Costa Rica	164
UK	136	Nicaragua	146
Ireland	135	Columbia	124
Netherlands	133	Brazil	111
Norway	121	Uruguay	109
Sweden	120	Mexico	104
Switzerland	118	Jamaica	99
Finland	113	Ecuador	97
Austria	102	Argentina	90
Germany	91	Chile	86
France	88	Venezuela	85
Hungary	86	Dominican Republic	81
Belgium/Luxembourg	85	Peru	80
Poland	81	Surinam	77
Italy	72	Guatemala	70
Yugoslavia	65	El Salvador	67
Spain	63	Panama	63
Portugal	57	Honduras	59
Greece	51	Paraguay	53
Rumania	38	Bolivia	50
North America			
Canada	137		
USA	134		
Australasia			
Australia	147		
New Zealand	134		
Africa		Far East	
South Africa	112	West Malaysia/Singapore	80
Mauritius	103	Pakistan	60
Morocco	97	Philippines	52
Somalia	33	Ceylon	50
Gambia	32	India	50
Uganda	30	Japan	50
Kenya	29	China (Taiwan)	32
Ghana	23	Indonesia	19
Ivory Coast	21	Korea	4
Madagascar	20		
Mozambique	20	Near East	
Tanzania	18	Jordan	113
Mali	15	Lebanon	111
Cameroon	5	Israel	108
Nigeria	4	Libya	90
		Iraq	81
		Iran	71
		UAR	49
		Afghanistan	39
		Syria	39
		Sudan	33
		Saudi Arabia	29

APPENDIX III. MEASUREMENT OF SUGAR CONSUMPTION BY QUESTIONNAIRE (ABSTRACTED FROM BETT *et al.*)

Several studies have been reported in which the consumption of sugar (sucrose) was measured by a method based on a simple questionnaire. The original method involved the completion of the form by an interviewer.<sup>2</sup> More recently, the questionnaire has been simplified further so that it can be completed by the subject himself.<sup>3</sup> Reasons have been given for the belief that the method is reliable<sup>4</sup> and more recently its reliability has been tested against the method that involves the subject recording in a diary all the food and drink consumed over a period of 7 days.<sup>5</sup>

The simplified questionnaire is set out below. In all studies attempts have been made to consider only those persons who, so far as could be ascertained, had had a constant sugar consumption for many years. For this reason questions were included relating to 'special' diets, and any subjects who were believed to have changed their sugar consumption were eliminated from the final assessments.

The calculation of the amount of sugar in prepared foods and drinks is made from analyses published in food tables or from figures supplied by manufacturers. As for sugar itself, a heaped teaspoon is taken as containing 6 g, a level teaspoon 4 g and a heaped dessertspoon 15 g.

Dietary questionnaire

Name ..... Age .....

If your weight has increased in the last few years, are you making a serious effort to check or decrease it? Yes/No

If 'Yes' are you restricting sweet or sugary foods, or sugar? .....

If you are on a special diet now why are you on this diet? .....

How long have you been on this diet? .....

Have you ever been on any other special diet? Yes/No

If 'Yes'

Why were you on this diet? .....

Approximately when did you start this diet? .....

How long did it last? .....

If your eating habits have permanently changed as a result of being on the diet, in what way? .....

Go through an average day in your mind, and write down how many cups of tea and coffee you consume:

	Tea	Coffee	Other hot beverages (cocoa, chocolate, etc.)
Before breakfast	..... cups	..... cups	..... cups
At breakfast	..... cups	..... cups	..... cups
Mid-morning break	..... cups	..... cups	..... cups
Midday meal	..... cups	..... cups	..... cups
Teatime	..... cups	..... cups	..... cups
Evening meal	..... cups	..... cups	..... cups
Bedtime	..... cups	..... cups	..... cups
Other	..... cups	..... cups	..... cups

APPENDIX II. INFORMATION ON SUGAR-INTAKE OF SOUTH AFRICAN POPULATIONS, PRELIMINARY FORM (SAIMR, JOHANNESBURG)

Name: ..... Ethnic Group: .....

Address: ..... Area: .....

How much sugar do you take in tea? ..... teaspoons  
 Are the spoons level or heaped? .....  
 How much sugar do you take in coffee? ..... teaspoons  
 Are the spoons level or heaped? .....

Have you always taken the same amount of sugar in these beverages? Yes/No

If 'No', how much did you take before? .....

When did you change? .....

Do you *regularly* use artificial sweeteners, e.g. saccharine, saxine, etc? Yes/No

How long have you used them? .....

How much of the following do you eat or drink *per week*?

Sweets, toffees, and fancy chocolates ..... lb ..... oz

No. of 2-oz chocolate bars .....

Fizzy drinks, non-alcoholic ..... glasses

(inc. tonic water, ginger-beer, etc.) ..... small bottles

Fruit squash ..... glasses

Fruit juice (tinned or bottled) ..... glasses

How many a *week* do you have of the following:

Porridge ..... portions

Plain breakfast cereals ..... portions

Sugar-coated breakfast cereals ..... portions

Jam or marmalade ..... teaspoons

Sweet biscuits ..... number

Pudding or sweet at midday (including tinned fruit) ..... portions

Pudding or sweet for tea or evening meal (including tinned fruit) ..... portions

Individual cakes and/or slices of cake ..... number

How many spoons of sugar do you take on breakfast cereals? .....

Are they teaspoons or dessertspoons? .....

Are they level or heaped? .....

How many spoons of sugar do you take on porridge? .....

Are they teaspoons or dessertspoons? .....

Are they level or heaped? .....

1 regular visitor (weekends) 22 meals/ month = 0.25 man-unit  
 1 garden boy 22 meals/month = 0.25 man-unit  
 1 casual visitor 5 meals/month = 0.05 man-unit  
 1 rare visitor 1 meal/month = 0.01 man-unit

#### Calculation

Assume *total* sugar consumption over 30 days to be

50 lb = 22.73 kg or 22 730 g

Hence, consumption *per diem* =  $\frac{22\ 730}{30} = 757.6$

Assume households units add up to 6.5 units

Then, consumption per man-unit *per diem* =  $\frac{757.6}{6.5} = 116$  g

#### APPENDIX V. CONVERSION FACTORS USED IN DIETARY ASSESSMENT\*

Item	Refined sugar (g)
1 level teaspoon sugar	4.0
1 heaped teaspoon sugar	6.0
1 small lump sugar	3.5
1 large lump sugar	7.0
1-oz boiled toffees, sweets, chocolates	24.0
1-oz block chocolate	15.0
1 sweet or semi-sweet biscuit	1.5
1 teaspoon jam or marmalade	5.0
1 teaspoon honey or syrup	6.0
1 glass non-alcoholic drink, squash	10.0
1 teaspoon of powdered Ovaltine, etc.	2.0
1 teaspoon of sweetened condensed milk	2.0

#### Sugar Content of Some South African Foods and Drinks

Product	Firm	Percentage of added sugar	Sugar content in g
Condensed milk	Nestlé	44%	172 g per 14-oz tin
Ice-cream	Wall		40 g per pint
Soft drinks	Coca Cola	10% - 12%	85 g per 'Family size' (770 ml)
			33 g per 'king size' (300 ml)
Fruit squash	Safari	30%	218 g per 26-oz bottle
Fruit squash	Tropical Fruits	1 lb : 2 pt juice	218 g per 26-oz bottle
Canned fruit	Langeberg	15% approx. (depending on fruit)	68 g per 1-lb tin
Jelly	Royal	80%	80 g per packet (100 g)
Instant pudding		70%	
Regular pudding		60%, 70%	70 g per packet (100 g)
Pie filling		50%	

\*From Burns-Cox, C. J., Doll, R. and Ball, K. P. (1969): Brit. Heart J., 31, 485.

#### APPENDIX IV. CALCULATIONS FOR CONSUMPTION OF SUGAR IN HOUSEHOLDS PER MAN-UNIT PER DIEM

1 adult = 90 meals/month = 1 man-unit  
 1 child 0-11 years 90 meals/month = 0.8 man-unit  
 1 full-time servant 90 meals/month = 1 man-unit

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