THE PREVALENCE OF DENTAL PATHOLOGY IN TWO DUTCH SKELETAL SAMPLES FROM THE EARLY 19TH CENTURY

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Abstract: Comparative analyses are presented of two dental samples, from the late 18th through the early 19th century, excavated in the Dutch towns of Zwolle and 's-Hertogenbosch. The analyses comprise the dental preservation rates, the attrition processes, the age distributions (by dental aging) and dental health. The differences in the preservation rate can be explained by the different techniques and procedures followed during the course of the excavation of the two samples. Furthermore they are a function of the differences in their respective age distributions. All other differences between the two samples can be viewed as being caused by the socio-economic differences between them.

I.INTRODUCTION

In this paper the results of the dental investigation of the skeletons excavated in the Broerenkerk at Zwolle, described in Aten (1990, 1992a), Bouts et al. (1992) and Constandse-Westermann et al. (unpublished), are compared to the data pertaining to another dental sample, i.e. that from the Sint Janskathedraal at 's-Hertogenbosch (Bouts et al. 1992; Pot 1988a). This skeletal sample has been excavated within the framework of a rescue excavation, conducted to obtain information about the churchyard and the underlying habitation remains before a new building project was erected on the terrain. This skeletal population dates from 1775-1858 AD and contains over 250 individuals, excavated to the north of the Sint Janskathedraal at 's-Hertogenbosch.

To date, only the dentitions of the 's-Hertogenbosch skeletons have been

studied. This implies that we do not yet have insight into the sex of the individuals in the sample. Therefore, for the comparison between the two samples we had to combine the sexes for the Zwolle material.

There are a number of factors which make the comparison between these two dental samples particularly interesting. In the first place, the scoring of all dental features has been executed according to the same methods and criteria (Perizonius & Pot 1981; Pot 1986, 1988a, b) and by the same investigators. Both samples are from middle-sized Dutch towns and date from the same period. The main difference between the two samples lies in the socio-economic differences between these two groups. In addition to this we will observe variation which is due to the techniques and procedures used during the two excavations.

II. THE SOCIO-ECONOMIC DIFFERENCES

The historical record (Aten 1992b; Hagedoorn 1992) showed that the skeletal sample from Zwolle represents only part of the town's population at the time. The majority of the buried individuals had lived in the direct surroundings of the church. They were mainly artisans, bargemen, people engaged in the services and people from the lower military ranks. Among the female individuals, we find seamstresses, servants, women living by private means, etc. The deceased or their families had to be sufficiently well-to-do to be able to purchase a grave within the church. However, the rich citizens were generally buried in one of the other churches in Zwolle, for example the Sint Michaëlskerk. The sample thus represents the social middle class.

The individuals excavated in 's-Hertogenbosch belonged to a quite different social grouping, i.e. they were from the lowest social classes. They could not afford the purchase of a grave within the church and for many of them no financial means at all were available for their burial. A charitable institution (de Godshuizen) had to take care of the interment of their remains.

III. THE EXCAVATION PROCEDURES

As to the techniques used in the two excavations it should be stated that the salvage of the skeletal material at Zwolle was the main aim of the excavation. The employed volunteers were carefully instructed as to the different bones of the human skeleton and the procedures to be followed. In 's-Hertogenbosch the starting point was less favourable. Only a few excavators were working, directly in front of the building-contractors' machinery. They had to investigate not only the cemetery (and salvage the skeletons) but also the underlying habitation levels.

IV. THE DENTAL SAMPLES

The dental sample from Zwolle is described in Bouts et al. (1992) and in Constandse-Westermann et al. (unpublished). The sample from 's-Hertogenbosch consists of 229 individuals: 179 adults and 50 children and adolescents. The comparable figures for Zwolle and 's-Hertogenbosch are presented in Table 1. The two distributions differ at the $p = .050$ level, but not at the $p = .010$ level by a Chi-suare two-sample test (Siegel 1956: 104-111). The distribution of the individuals over the sub-adult and adult categories does not differ significantly between the two samples.

Table 1. The composition of the dental samples from Zwolle and 's-Hertogenbosch.

	CHILDREN AND ADOLESCENTS[1] (≤ 21 years)			ADULTS (> 21 years)
	Deciduous dentitions	Exfoliating dentitions	Permanent dentitions	Permanent dentitions
Zwolle	54	13	11	334
's-Hertogenbosch	23	15	12	179

$\Sigma X^2 = 7.898$; d.f. = 3, $.050 > p > .020$.

	TOTAL SUBADULTS	ADULTS
Zwolle	78	334
's-Hertogenbosch	50	179

$\Sigma X^2 = .776$; d.f. = 1, $.500 > p > .300$.

[1] Deciduous dentitions: no permanent dental elements in occlusion;
Exfoliating dentitions: at least one permanent dental element in occlusion;
Permanent dentitions: all permanent anterior teeth and premolars in occlusion.

The material from Zwolle contained 27 adult individuals for which an age estimation by dental attrition was impossible. Therefore the (age-related) pathological phenomena in the adult group could be presented here for 307 individuals only.

V. RESULTS

V.1. The preservation rate

The preservation rate of a dental sample is the percentage of elements/alveolar sites in the jaw which are available for investigation, in other words, which present information as to their status or former history. An element/site is considered 'present' when information as to its status and/or foregoing processes is available, while 'absent' implies non-

informative. The preservation rate for the permanent dentitions from 's-Hertogenbosch has been calculated by Pot (1988a) for the total adolescent and adult sample[i] and for the three functional classes. These figures are presented in Table 2, together with the comparable data from the Zwolle material. The table shows the higher quality of the Zwolle dental material. The preservation rates for the locations in the jaw are on the average 12.1 % above those from 's-Hertogenbosch. For the dental elements this difference is 24.2 %. Chi-square two-sample tests on the absolute numbers demonstrate that all differences are significant at the $p < .001$ level.

As stated in Constandse-Westermann et al. (unpublished), the distribution of the preservation rate over the two functional classes of deciduous elements is age-related, because it is dependent upon the numbers of dental germs versus those of fully erupted and functioning elements. Therefore only overall figures are presented for those teeth. The figures for the dentitions which are in the process of exfoliation are extremely biased and have been omitted in Table 2. The deciduous dentitions shows a non-significant difference for the proportions of preserved elements and an inverse, highly significant difference for the alveolar bone sites.

Table 2. The preservation rates for the permanent and the deciduous dentitions in Zwolle and 's-Hertogenbosch.

PERMANENT TEETH: PERCENTAGE INFORMATIVE

	Anterior teeth	Premolars	Molars	N (individuals)
Dental elements				
Zwolle	64.5 %	72.2 %	71.1 %	345
's-Hertogenbosch	46.7 %	50.0 %	39.2 %	191

Anterior teeth $\Sigma X^2 = 191.713$, d.f. = 1, $p < .001$;
Premolars $\Sigma X^2 = 210.588$, d.f. = 1, $p < .001$;
Molars $\Sigma X^2 = 650.287$, d.f. = 1, $p < .001$.

Bone sites				
Zwolle	79.6 %	80.0 %	76.8 %	345
's-Hertogenbosch	70.0 %	70.0 %	60.0 %	191

Anterior teeth $\Sigma X^2 = 75.002$, d.f. = 1, $p < .001$;
Premolars $\Sigma X^2 = 54.768$, d.f. = 1, $p < .001$;
Molars $\Sigma X^2 = 202.609$, d.f. = 1, $p < .001$.

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DECIDUOUS TEETH: PERCENTAGE INFORMATIVE

		N (individuals)
Dental elements		
Zwolle	54.5 %	54
's-Hertogenbosch	54.1 %	23

$\Sigma X^2 = .022$, d.f. = 1, $.900 > p > .800$.

Bone sites		
Zwolle	41.8 %	54
's-Hertogenbosch	71.1 %	23

$\Sigma X^2 = 111.000$, d.f. = 1, $p < .001$.

V.2. The attrition rate

A significant difference is observed between the attrition rates of the two samples. This rate, i.e. the pace of the attrition proces in the population studied, is estimated by calculating the average of the differences, per person and per dental quadrant, between the degrees of attrition of the first two molars (Table 3). In the table three age-related averages are presented: for second molars having degrees of attrition between 2- and 2+, between 3- and 3+ and ≥ 4 respectively. The Kolmogorov-Smirnov two-sample test (Siegel 1956: 127-136) has been executed on the total distributions (vide Bouts et al. 1992; Constandse-Westermann 1997). The table shows that the nature and size of the differences are largely independent of the, age-related, overall degree of attrition of the dentitions studied. The average rate of attrition calculated for a population sample is important in calibrating the age estimations based upon that process. For a sample with a low attrition rate, i.e. a slow attrition process, individuals with a specific degree of wear of their teeth should be placed in a higher age class than for a sample with a higher attrition rate, i.e. a faster process of wear (Constandse-Westermann 1997; and vide below).

Table 3. The average difference in the degree of attrition between the first and the second molar, per individual and per quadrant, for three age-related groups of second molars.

	M2's with attrition 2-/2+ Diff. (N)	M2's with attrition 3-/3+ Diff. (N)	M2's with attrition ≥ 4 Diff. (N)
Zwolle	.469 (129)	.492 (62)	.481 (26)
's-Hertogenbosch	.611 (175)	.688 (58)	.515 (17)

Komolgorov-Smirnov two-sample test: N1 = 217, N2 = 250, p< 001.

V.3. The age distributions

As stated in Constandse-Westermann et al. (unpublished), the ages of the individuals in the Zwolle sample have been estimated by dental criteria. However, the presentation of these age distributions formed a problem, because for the identified sub-sample real ages were available, while for the unidentified, larger sub-sample this was not the case. A satisfactory agreement was extant between the real and the estimated ages of the identified children and adolescents and their age distribution did not differ significantly from that of the unidentified sub-adults by a Kolmogorov-Smirnov two-sample test ($p < .100$). This permitted us to present an age distribution based on the combination of the real ages of the identified sub-adult individuals and the estimated ages of those which were not identified (vide also Constandse-Westermann et al. unpublished, note 1). In the adult group, on the other hand, such a procedure appeared problematic. Despite the significant (58.8 %; $\Sigma X^2 = 55.234$, d.f. = 1, $p < .001$) improvement in the interpretation of the age classes based on dental attrition and alveolar resorption, as has been accomplished by our calibration method (Bouts et al. 1992; Constandse-Westermann 1997) differences between the real and the estimated age classes remained extant in 20 % of the cases. The best solution to this problem was to use the estimated ages of all individuals, according to our calibrated interpretation. These estimated ages could then be compared to the estimated ages for the sample from 's-Hertogenbosch.

Comparing these two age distributions, we encountered the problem that for 's-Hertogenbosch we possessed only limited means to calibrate the age distribution. To date, our Zwolle sample is the only one for which an average attrition-difference between the first and the second molars has been linked to a distribution of the real ages in part of the sample, enabling calibration. As stated earlier (Constandse-Westermann 1997) it would be highly rewarding to calculate this difference for other skeletal series of known age.

Because the average attrition rate for 's-Hertogenbosch is higher than that for Zwolle (vide above), but lower than that of most other (earlier)

samples for which this rate has been determined (Constandse-Westermann 1997: Table 1), we had two extreme options: 1. calibrating the 's-Hertogenbosch age classes in a similar way to those for Zwolle and 2. not calibrating them at all. In view of the results of our earlier investigation of the attrition rate in dental samples from The Netherlands, dating to periods between the 3rd and the 19th century AD (Constandse-Westermann 1997), the correct interpretation of the age classes for the 's-Hertogenbosch sample certainly lies somewhere between these two options. We therefore opted for an intermediate solution, i.e. we re-calculated Pot's age distribution for 's-Hertogenbosch to accommodate our calibrated age classes, but ignoring the overlap between them.

The resulting age distributions in the two samples are presented in Table 4. The total age distributions as well as those for only the adolescents (> 15 years) and adults[ii] differ significantly between the two samples according to Kolmogorov-Smirnov two-sample tests. The significance of the differences between these cumulative Kolmogorov-Smirnov distributions is caused mainly by the lowest and the highest adult age classes, respectively, being relatively over-represented and absent in the 's-Hertogenbosch sample. The differences in the children's age classes are relatively small, rising only slightly rise (to 5.7 %) in the adolescent group (15-21[iii]). The sub-adult distributions (< 21 years) differ only at the $.050 > p > .025$ level.

Table 4. The age distributions in the samples from Zwolle and 's-Hertogenbosch.

Age classes	Zwolle	's-Hertogenbosch
0-1	24	8
1-5	26	13
5-10	10	8
10-15	8	2
15-21	10	19
22-30	25	99
25-50	72	60
45-70	99	20
> 65	111	-

Komolgorov-Smirnov two-sample tests.

Total distributions: N1 = 385, N2 = 229, $p < .001$;

Adolescents + adults (>15): N1 = 317, N2 = 198, $p < .001$;

Children + adolescents (<21): N1 = 78, N2 = 50, $.050>p>.025$.

V.4. Hypoplasia

A third difference between the samples from Zwolle and 's-Hertogenbosch is in the frequency of individuals with hypoplastic lesions. The samples contain 51 out of 412 (12.4 %) and 60 out of 229 (26.2 %) individuals with such lesions, respectively. The difference is significant by a Chi-square two-sample test ($\Sigma X^2 = 19.546$, d.f. = 1, $p < .001$.

V.5. Dental pathology

As stated above, sex differences could not be taken into account in the comparison between the degree of dental pathology in our two samples. For the sub-adult groups this did not create a problem because we found no indications of the existence of such differences in the identified children in the Zwolle sample.

For the adult age classes, combination of the sexes in this comparison was only permitted if we assumed that the sex distributions in the two

samples did not significantly differ. Because this distribution in many cemetery samples drawn from 'normal' populations does not significantly differ from a 1 : 1 ratio, as is the case in that part of our Zwolle sample for which the sex was known or could reliably be determined[iv],we have decided to make that assumption. This implied that we could make use of all the individuals in the Zwolle sample to make this comparison, including the individuals of undetermined sex.[v]

Table 5 presents the frequencies of pathology in the permanent dentitions in the samples from Zwolle and 's-Hertogenbosch.[vi] The table shows that there are higher percentages of dental pathology in the children and adolescents from the Zwolle sample than in those from 's-Hertogenbosch in eight out of 18 cases. However, only two of these 18 differences are significant at the $p \leq 050$ level. i.e. those in the caries frequencies of the molars. For the adults the relation is inverse: adult dental pathology shows the higher frequencies in 's-Hertogenbosch. The difference occurs systematically (in 24 out of 27 possible cases). It is statistically significant in only two (out of nine) cases for the caries frequencies, in six cases (all in the higher age classes) for the periapical lesions and in seven cases for the frequencies of ante mortem loss.

Table 5. Dental pathology in Zwolle and 's-Hertogenbosch(percentages based on totals of ≤25 elements are placed in brackets).[1]

CARIES

Estimated age class		Number of indiv.	Anterior	[n]	Premolars	[n]	Molars	[n]
6-15	Zwolle	13	3.4%	[58]	(0.0%)	[25]	21.6%	[51]
6-16	's-Hert.bosch	32	0.0%	-	4.3%	-	8.1%	-
			p = .059		p = .590		.010>p>.001	
15--21	Zwolle	10	8.6%	[93]	7.8%	[64]	34.8%	[69]
17(-21)	's-Hert.bosch	18	2.9%	-	1.9%	-	15.8%	-
			.100>p>.050		p = .099		.010>p>.001	
22-30	Zwolle	25	4.4%	[182]	6.1%	[147]	17.9%	[190]
	's-Hert.bosch	99	7.1%	-	12.1%	-	24.9%	-
			.300>p>.200		050>p>.010		.800>p>.700	
25-50	Zwolle	72	7.4%	[597]	9.4%	[424]	28.1%	[502]
	's-Hert.bosch	60	9.4%	-	10.1%	-	24.0%	-
			.300>p>.200		.900>p>.800		.300>p>.200	
45-70	Zwolle	99	12.7%	[677]	16.9%	[439]	31.5%	[358]
	's-Hert.bosch	20	12.0%	-	17.2%	-	48.0%	-
			.800>p>.700		.900>p>.800		.010>p>.001	
> 65	Zwolle	111	23.2%	[237]	28.0%	[164]	40.2%	[111]
	's-Hert.bosch	0	-	-	-	-	-	-

PERIAPICAL PROCESSES

Estimated age class		Number of indiv.	Anterior [n] teeth	Premolars [n]	Molars [n]
6-15	Zwolle	13	1.4% [74]	(0.0%)[23]	5.5% [55]
6-16	's-Hert.bosch	32	0.0% -	0.0% -	1.8% -
			p = .233	test invalid	p = .151
15--21	Zwolle	10	0.0% [97]	0.0% [66]	8.8% [68]
17(-21)	's-Hert.bosch	18	0.0% -	0.0% -	2.4% -
			test invalid	test invalid	p = .065
22-30	Zwolle	25	1.3% [227]	5.2% [154]	7.8% [204]
	's-Hert.bosch	99	1.7% -	6.3% -	11.2% -
			p = 1.000	.700>p>.500	.200>p>.100
25-50	Zwolle	72	3.0% [732]	7.6% [471]	15.3% [583]
	's-Hert.bosch	60	8.3% -	12.8% -	21.7% -
			.050>p>.010	.050>p>.010	.050>p>.010
45-70	Zwolle	99	10.0% [909]	19.6% [542]	26.6% [451]
	's-Hert.bosch	20	13.0% -	28.6% -	36.9% -
			p < .001	.050>p>.010	.050>p>.010
> 65	Zwolle	111	25.6% [441]	30.3% [234]	43.0% [165]
	's-Hert.bosch	0	- -	- -	- -

ANTE MORTEM LOSS

Estimated age class		Number of indiv.	Anterior teeth [n]	Premolars [n]	Molars [n]
6-15	Zwolle	13	0.0% [71]	(0.0%)[22]	0.0% [47]
6-16	's-Hert.bosch	32	0.0% -	0.0% -	0.0% -
			test invalid	test invalid	test invalid
15--21	Zwolle	10	0.0% [97]	0.0% [66]	0.0% [71]
17(-21)	's-Hert.bosch	18	0.0% -	0.0% -	1.2% -
			test invalid	test invalid	p = .542
22-30	Zwolle	25	1.7% [233]	0.6% [157]	6.1% [230]
	's-Hert.bosch	99	1.5% -	2.9% -	12.5% -
			p = 1.000	p = .140	.010>p>.001
25-50	Zwolle	72	1.5% [753]	6.0% [504]	16.4% [725]
	's-Hert.bosch	60	6.0% -	15.8% -	33.6% -
			p < .001	p < .001	p < .001
45-70	Zwolle	99	8.4% [1002]	16.9% [658]	46.5% [886]
	's-Hert.bosch	20	67.2% -	76.6% -	87.0% -
			p < .001	p < .001	p < .001
> 65	Zwolle	111	58.5% [1096]	67.9% [739]	79.4% [841]
	's-Hert.bosch	0	- -	- -	- -

1. In order to be able to test the differences in this table we had to estimate the total numbers of elements for 's-Hertogenbosch. This was done on the basis of the numbers of individuals in each age class and the preservation values for the anterior teeth, premolars and molars as presented by Pot (1988a: Table 6).

VI. DISCUSSION AND CONCLUSIONS

It has been stated in Constandse-Westermann et al. (unpublished) that the preservation rate of dental material is highly dependant upon the three functional groups concerned. This was demonstrated by the Zwolle material and is confirmed by the preservation rate observed in the adult sample from 's-Hertogenbosch (vide Table 2).

The table shows clearly the difference in excavation techniques between the two samples. Especially the high preservation of the anterior teeth shows that in the case of the Zwolle excavation considerable attention

could be paid to the instruction of the volunteers which were employed, to their supervision during the excavation and to the precision with which the excavation was conducted. In 's-Hertogenbosch the circumstances were less favourable, as stated above.

Furthermore, the difference between the preservation rates of the two samples is a function of the differences in their age distributions and in the resulting frequencies of ante mortem loss. In Constandse-Westermann et al. (unpublished) it is explained that ante mortem lost elements, presenting the investigator with information as to their status, are counted as 'present' in the calculation of the preservation rate. Despite the fact that, as we have seen, the 's-Hertogenbosch sample shows the most severe dental pathology per age group, the difference in the age distributions between the two samples causes the total frequency of ante mortem loss to be significantly higher in the Zwolle material (Table 6). This is an additional cause of the high preservation rate calculated for the Zwolle material. Also as a consequence of the differential age distributions we did not observe statistically significant differences in the total frequencies of other pathological phenomena. Therefore, in this case, the relatively high frequency of pathology per age group in the 's-Hertogenbosch sample (vide V. 5) has not lead to the differences in preservation rate between the two groups.

Table 6. The absolute numbers of ante mortem lost teeth in Zwolle and 's-Hertogenbosch.

	Number of ante mortem lost dental elements	Number of registrable cases
Zwolle	2597 (32.2%)	8058
's-Hertogenbosch	609 (15.1 %)	4036

$\Sigma X^2 = 405.494$, d.f. = 1, $p < .001$

All other differences between the Zwolle and the 's-Hertogenbosch material can most plausibly be viewed as being caused by the social differentiation between the individuals in these two skeletal samples from

around 1800 AD. The dental attrition rate, the age distributions, as well as the occurrence of hypoplasia and that of other dental pathology can probably all be related to socio-economic factors, particularly the documented differences in dietary patterns between the social groups.

The differences in the attrition rate may well be caused by differences in food patterns. A number of sources, compiled by Burema (1953) from a number of contemporaneous publications as well as from modern historical studies, state that in The Netherlands at the end of the 18th and the beginning of the 19th century the diet of the well-to-do contained less coarse-grained foodstuffs than that of the lower-class groups. This was mainly due to the use of rye bread, buckwheat and sometimes unbolted wheat bread by the poor versus bread made of bolted flour by the rich. Furthermore the bread of the poorer people was sometimes mixed with chaff, calcined bones or bone jelly (as a source of protein) and chalk (to hide the colour of the ground beans which were also added to the cheaper bread). Burema also mentions the use of "Hollands zand", relatively inexpensive brown sugar, imported from the Dutch colonies in that period, which was not infrequently mixed with sand.

The differences in the age distributions, the occurrence of hypoplasia and the general dental health status can also readily be related to dietary differences, most probably in combination with the strenuous life circumstances of the poor. Studying Burema's sources again we find that the farm labourers as well as those in the towns were often living on potatoes (three times a day). Other elements of the poor man's diet were rye bread, course vegetables (carrots, onions, beans, often preserved in salt), groats and other farinaceous foods, some fish, buttermilk, separated milk instead of whole milk, etc. Hardly any meat was available to them, at best some bacon, and little fresh vegetables or fruit. All this, often combined with considerable abuse of alcohol, led to a high morbidity, for example high prevalences of deficiency diseases (scurvy, rickets, etc.). The diet of the middle classes was also sober at that time period but their higher incomes allowed them to purchase a larger variety of foodstuffs, particularly meat, fish, fruit and (a variety of) vegetables which were available in most parts of The Netherlands during the late 18th and early 19th centuries.

The above shows us that the difference in the nutritional value of the diets of our two groups has probably been considerable, with direct consequences for their (dental) health status.[vii] Other sources, in which the economic situation is related to bodily characteristics, e.g. stature, also indicate the detrimental health situation of the town-populations in the province of Noord-Brabant, where the town of 's-Hertogenbosch is situated, during the period in question (Constandse-Westermann 1968 and contained sources). The poor dental health of the 's-Hertogenbosch individuals may have been enhanced by relatively large amounts of carbohydrates contained in their diet. A differential use of sugar is reported only for the later part of the period from which our sample dates. Burema (1953) reports that around 1750 sugar ("Hollands zand" vide above) was used in all social milieus in The Netherlands, even in those of the less well-to-do. From the end of the century it is reported that "the ordinary man loaded his children daily with sweets". Only from around and especially after 1800 does he cite sources mentioning that the 'common people' could not use much sugar because of its high price. The introduction of the 'Continental Blockade' by Napoleon I in 1807 contributed considerably to the rise of the price of sugar. The general use of refined beet sugar started only in the second half of the 19th century in The Netherlands, because of tax laws which made its production financially unattractive up to ca 1850.

In conclusion we can state that the differential food patterns of our two samples are clearly reflected in their dental pathology and attrition. Under circumstances where other habitual activities involving the dental apparatus can be excluded, we consider both to be good indicators of the socio-economic differences between samples.

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i. In order to exclude the possibility, that the occurrence of not, or only partly erupted elements would bias the calculated preservation rate, Pot did not use the dentitions which were in the process of exfoliation in this calculation.

ii. Aten (1990, 1992b) states that the excavation trenches in the Broerenkerk were chosen in such a manner, that a maximum number of identified individuals and a maximum number of young children could be expected. Therefore, despite the not-significant difference between the children/adult distributions in the two samples, there may exist a slight bias in the proportion of children in the Zwolle sample.

iii. According to our findings (Bouts et al. 1992, Constandse-Westermann 1997) we have considered Pot's (1988a) age class 15-18 to be equivalent to our age class 15-21.

iv. No significant deviation from the 1 : 1 ratio occurred in the total adult sample and in three of the four age classes separately. Only in the youngest age class we found an under-representation of males. In view of the systematic differences in dental pathology between the male and the female sub-samples, more males in this age class would have lowered its average degree of pathology and therefore enlarged the difference in the pathology frequencies between Zwolle and 's-Hertogenbosch. Therefore it can not be claimed that the

differences between the two samples discussed in this paper are due to bias in their sex distributions.

v. For this comparison we omitted the correction of the percentages of caries as recommended and executed in Constandse-Westermann et al. (unpublished), because such a correction was not applied in the calculation of the caries frequencies for 's-Hertogenbosch (Pot 1988a).

vi. Because the deciduous dentitions of the children from 's-Hertogenbosch are presently not accessible for analysis, we had to limit our comparison to the pathology of the permanent teeth.

vii. The skeletal pathology of the two groups has not yet been studied sufficiently to make further statements as to their health status. A study of the influence of occupational stress of those individuals in the Zwolle material of which their professions during life were known is in progress. The skeletal study of the 's-Hertogenbosch material will probably start in the summer of 1995.